Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

HYDROGEOLOGICAL REPORT
OLD FORT ROAD BRIDGE
SOUTH OF HWY 12, ABOVE THE TRANSCANADA TRAIL
TOWNSHIP OF TAY
COUNTY OF SIMCOE, ONTARIO

PREPARED FOR: Lea Consulting Ltd.
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EXECUTIVE SUMMARY

Terraprobe Inc. (Terraprobe) has been retained by Lea Consulting Ltd. (LEA) on behalf of the County of Simcoe to provide hydrogeological engineering services in support of the replacement of the existing Old Fort Bridge ("the Site") with a single span bridge supported on spread footings, in the Township of Tay, County of Simcoe, Ontario. The Trans Canada Trail crosses the Site below the existing bridge, approximately 285 m south of the intersection of Old Fort Road and Highway 12.

The purpose of this study was to assess the groundwater conditions and dewatering requirements for construction activities associated with the bridge replacement.

The conclusions of the investigation are:

- The northern extent of the Site and the study area are noted to be within a significant groundwater recharge area (SGRA), indicating that aquifer recharge in the area is dependent on rainfall infiltration.
- Soils at the Site can be characterized as deposits of fill overlying a layer of sand overlying silty sand to sandy silt deposits. A thin layer of clayey silt was encountered in the boreholes drilled north and south of the bridge embankments.
- Stabilized groundwater levels at the Site were observed at an elevation of 191.6 masl (depth of 3.7 m below existing grade) at the north section of the Site and at an elevation of 188.7 masl (depth of 5.6 m below existing grade) at the southern section of the Site.
- Based on a review of the in-situ test results, the grain size analysis and published hydraulic conductivities for the investigated soils, the hydraulic conductivity of the sandy silt to silty sand soils is estimated to be 2.13×10^{-7} m/s.

The following dewatering requirements are expected given the requirements for bridge replacement and improvements at the Site:

- Dewatering is anticipated to be required for footing construction of the new bridge and it is envisaged that open cut excavations will be required extending to undisturbed competent native soils.
- The estimated water taking volume from excavations required to construct the footings simultaneously is approximately 29,500 L/day. The dewatering system should also be designed to accommodate a typical 2-year design storm event (37 mm rainfall event) which will generate approximately 86,500 L/day, hence resulting in a total anticipated dewatering volume of approximately 116,000 L/day.
- Construction dewatering activities will require a posting to the Ontario Ministry of the Environment Conservation and Parks (MECP) Environmental Activity and Sector Registry (EASR). Posting to the EASR is required for construction dewatering activities where the dewatering volume is more than 50,000 L/day and less than 400,000 L/day.
- Construction dewatering activities will not require an application to the Ontario Ministry of the Environment Conservation and Parks (MECP) for a Permit to Take Water (PTTW). A PTTW is only required for dewatering volumes that exceed 400,000 L/day.

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1.0 INTRODUCTION

Terraprobe Inc. (Terraprobe) has been retained by Lea Consulting Ltd. (LEA) on behalf of the County of Simcoe to provide hydrogeological engineering services in support of the of Old Fort Bridge ("the Site") replacement with a single span bridge supported on spread footings, in the Township of Tay, County of Simcoe, Ontario. The Trans Canada Trail crosses the Site below the existing bridge structure, approximately 285 m south of the intersection of Old Fort Road and Hwy 12,

The scope of work for the hydrogeological engineering services is outlined in Terraprobe's proposal titled *"Consulting Engineering Services, Hydrogeological Assessment, Old Fort Road Bridge Replacement, Simcoe County, Ontario"* dated February 25, 2021.

The purpose of this study was to assess the groundwater conditions and dewatering requirements for the proposed construction activities associated with the bridge replacement.

The following third-party report, provided by LEA, was reviewed for background information relevant to the geological and hydrogeological conditions of the Site and study area:

- Thurber Engineering Ltd. (2021), *"Foundation Investigation and Pavement Design Report, Old Fort Overhead Bridge Replacement, County of Simcoe, Ontario". File No. 28556*, Issued March 31, 2021.

2.0 SCOPE OF WORK

The scope of work for the hydrogeological investigation consisted of the following:

- *Review of background information and completion of site inspection.* Documents available for the study area were reviewed to determine the status of existing wells, local and regional stratigraphy, groundwater flow direction, and any areas of concern identified by source water protection jurisdictions. A site inspection was also completed to confirm existing site conditions including adjacent site use, topography, drainage, and vegetation.
- *Completion of single-well response tests.* Groundwater measurements were obtained from the installed monitoring wells and single well response tests were carried out in these monitoring wells. The results of these single-well response tests were used to estimate the hydraulic conductivities of the subsurface soils.
- *Dewatering Assessment.* An assessment of the groundwater inflow rates and volumes into open excavations was carried out for the two footing locations based on estimated hydraulic conductivity values obtained from the single well response tests and soil grain size information.
- *Hydrogeological Report.* A hydrogeological report has been prepared as part of the deliverable requirements. Provided within the report are recommendations on the estimated dewatering volumes and rates as well as mitigation measures that are likely required.

3.0 DESCRIPTION OF SITE CONDITIONS

3.1 Site Location and Description

The north limit of the project is approximately 285 m south of the intersection of Old Fort Road and Highway 12, i.e. approximately Sta. 10+556, and the south limit is approximately 50 m south along Old Fort Road, i.e. Sta. 10+607 with chainage increasing from north to south.

Within the project limits Old Fort Road is a paved two-lane rural road that crosses above the Trans Canada Trail via an existing two-lane bridge. The road shoulders north and south of the bridge are unpaved. A ditch was noted below the bridge, adjacent to the Trans Canada Trail and draining east towards Wye Marsh. The north and south project limits are bounded by residential properties.

3.2 Site Topography and Drainage

The Site has an approximate ground surface elevation varying between Elev. 195.3 masl and Elev. 194 masl and generally slopes to the north. Surface water runoff from the road and bridge deck is flows towards the north, and also down the embankment side slopes towards a watercourse located next to the Trans Canada Trail, beneath the bridge structure.

The watercourse passing through the site below the bridge drains into Wye Marsh located approximately 700 m west of the Site. Hog Bay is located approximately 1.5 km east and northeast of the Site, Tiffin Basin is located approximately 2.6 km northwest of the Site and Wye River which connects Tiffin Basin to Wye Marsh, is located 1.7 km northwest of the Site. Locally, groundwater is expected to flow to the west towards Wye River, Tiffin Basin and Wye Marsh and east towards Hog Bay. These hydrologic features and their location with respect to the Site are shown in the Hydrologic Features map in Appendix A.

3.3 Regional Physiography and Geology

Based on published geological information for the area, the Site falls within the Simcoe Uplands physiographic region. The overburden at the Site is composed of foreshore and basinal coarse-textured glacioclustrine deposits consisting of sand and gravel, minor silt and clay.

The bedrock at the Site is of the Bobycageon Formation, which is comprised of medium to thick-bedded limestone. Based on historic borehole information from the Minstry of Northern Development, Mines, Natural Resources and Forestry (MNRF) and Water Well Records in the vicinity of the Site from the Ministry of the Environment, Conservation and Parks (MECP), the depth to bedrock at vicinity of the Site is approximately 24.7 m. Geologic mapping illustrating the Site and the Study Area is provided in Appendix A.

The geological and hydrogeological conditions in the vicinity of the Site were also assessed based on the MECP well records, attached in Appendix B. The MECP well locations are presented in Figure 2.

3.4 Regulatory Mapping

Per Conservation Ontario mapping, the Site does not fall within the jurisdiction of any conservation area, as such it is not regulated.

The Site is fully located within the Severn Sound watershed of the South Georgian Bay Lake Simcoe Source Protection Region. According to the Source Protection Information Atlas, the Site does not fall within a wellhead protection area or a highly vulnerable aquifer. It is noted that the northern limits of the Site constitute as a significant groundwater recharge area (SGRA) under the Clean Water Act, indicating that aquifer recharge in the area is dependent on rainfall infiltration. It is noted that the area adjacent west of the Site is a Natural Heritage System with wetlands and woodlands. Wye Marsh, located approximately 700 m west of the Site, is considered a regionally significant life science area per the MNRF.

Due to the presence of a SGRA within the Site or study area, dewatering and construction activities on Site must adhere to the applicable requirements under the Clean Water Act.

3.5 Groundwater Resources

The MECP records of wells located within approximately 500 m of the Site (Appendix B) were reviewed to assess the general nature and use of the groundwater resource in the area. A summary of the data obtained from this review is presented below. It should be noted that enforcement of the "*Ontario Water Resources Act, R.R.O. 1990, Regulation 903*" increased the number of wells that were tagged and recorded within the last 10 years creating a bias in the number of wells recorded by the MECP during this period.

Well Construction

Wells finished in bedrock	1
Wells finished in overburden	23
Total	**24**

Well Uses

Monitoring/Test Hole	6
Domestic	17
Unknown/Not Used	1
Livestock	0
Municipal	0
Public Supply	0
Dewatering	0
Commercial	0
Industrial	0
Total	**24**

Well Depth

Less than 15 m	7
15 to 30 m	1
Greater than 30 m	1
Unknown or no well	15
Total	**24**

According to the MECP well records, two decommissioned municipal wells are present in the Study Area. The MECP well locations are presented in Figure 2.

Based on water well records in the local area and previous investigations completed at the Site, the approximate depth to groundwater varies from 1.8 to 25 m below ground surface. Locally, the groundwater level is expected to follow the topography and groundwater flow is west towards the Wye Marsh. Regionally, groundwater is expected to flow north towards Georgian Bay. Site features are presented in Figures 3.

In an attempt to obtain private well records for properties within the vicinity of the Site, a private well survey was carried out on April 13, 2021. Private wells were either capped, decommissioned, or access was not provided by the owners. Based on the site observations, it is anticipated that the majority of the properties within the vicinity of the Site are serviced with a combination of municipal water and private wells. It is expected that the lack of response/access received may be because of the ongoing coronavirus (COVID-19) pandemic.

3.6 Results of Subsurface Investigation

The fieldwork for this project was carried out on May 7, 2021 after obtaining utility clearances and permits. The work was performed in accordance with the lane closure times specified by the County of Simcoe and the Township of Tay. The subsurface investigation consisted of the completion of the following:

- Two boreholes (BH1 and BH2) were drilled north and south of the Old Fort Road Bridge, within the right of way of Old Fort Road to an approximate depth of 9.4 m below existing grade and both boreholes were instrumented with monitoring wells at depth.

The two boreholes were located as close to the future abutments as practically possible, while allowing for safe drilling operations and also avoiding drilling into existing structures. The boreholes were drilled with a truck-mounted drill rig operated by specialist drilling contractors. Terraprobe's staff observed and recorded the drilling, sampling and in-situ testing operations and logged the boreholes. Soil samples were obtained using a 50 mm outside diameter split spoon sampler in conjunction with Standard Penetrating Testing. The recovered soil samples were visually inspected and recorded in the field and placed in labelled plastic containers for further laboratory testing and analysis including natural moisture content and grain size distribution analysis.

Groundwater conditions in the open boreholes were observed during the drilling operations. Standpipe piezometers consisting of a 50 mm diameter PVC pipe with a slotted screen were installed in Boreholes 1 and 2 to permit longer term groundwater level monitoring.

Details of the encountered soil stratigraphy are presented on the Borehole Logs, in Appendix C, and an overall description of the site stratigraphy is provided below. It should be noted that the stratigraphic boundaries shown on the borehole logs are inferred from non-continuous soil sampling and represent transitions between soil types rather than exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

In summary, flexible pavement and fill material consisting of gravelly sand fill overlying a layer of sand fill, were encountered at the Site. The native overburden deposits consist of sand, soft clayey silt and silty sand to silt and sand.

3.6.1 Pavement Structure

Both Terraprobe boreholes were completed within the right of way of Old Fort Road within the project area. A flexible pavement consisting of asphaltic concrete, underlain by granular material was encountered. Pavement composition on Old Fort Road ranged from approximately 65 to 200 mm layers of asphalt, with a granular base/subbase approximately 65 mm in thickness.

Thurber drilled BRDG-01 and BRDG-02 through the deck of the existing bridge, encountering a 225mm thick concrete layer.

3.6.2 Earth Fill

Gravelly sand fill underlain by a layer of sand fill was encountered at this Site. Thurber encountered sand fill at ground surface in TUN-01 and TUN-02. The fill extended to a maximum depth of 3.0 m. Rock fragments were noted in the fill layer. The soils were noted to be generally brown and moist with occasional black and orange mottling.

The locations, thicknesses, depths and base elevations of the fill are summarized in the following table.

Borehole ID	Fill Thickness (m)	Fill Depth (m)	Fill Base Elevation (masl)
BH 1	2.8	2.9	192.3
BH2	2.8	2.9	191.2
BRDG-01	0.6	5.2	188.7
BRDG-02	2.2	7.2	188.4
TUN-01	2.1	2.1	185.0
TUN-02	0.7	0.7	186.4

3.6.3 Sand

A native sand deposit was encountered below the fill in the Terraprobe borehole BH2 and also in the Thurber boreholes BRDG-01 and BRDG-02. The sand layer contained some silt and trace to some gravel. The sand was noted to be wet and loose. A layer of gravelly sand was encountered in BH2, underlying the clayey silt. The location, thickness, depth and base elevation of the sand deposit are summarized in the following table.

Borehole ID	Thickness (m)	Depth (m)	Base Elevation (masl)
BH 2	1.1	4.0	190.2
BH 2	1.4	7	187.2
BRDG-01	0.9	6.1	188
BRDG-02	1.1	8.3	188.4

3.6.4 Clayey Silt

A layer of clayey silt was encountered at the Site. The clayey silt was brown, moist and soft. The locations, thicknesses, depths and base elevations of the clayey silt deposits are summarized in the following table.

Borehole ID	Thickness (m)	Depth (m)	Base Elevation (masl)
BH 1	1.1	4.0	191.3
BH 2	1.6	5.6	188.6

3.6.5 Silty Sand Till

Silty sand to sandy silt till deposits were encountered at this Site. The sands were noted to be grey and wet. The locations, thicknesses, depths and base elevations of the silty sand deposits are summarized in the following table.

Borehole ID	Thickness (m)	Depth (m)	Base Elevation (masl)
BH 1	5.3	9.3*	186.0
BH 2	2.4	9.4*	184.8
BRDG-01	9.3	15.4	178.7
BRDG-02	5.7	14	181.7
TUN-01	8.7	10.8	176.2
TUN-02	7	7.7	179.3

*Borehole termination depth

3.7 Groundwater Levels

Groundwater conditions were observed in the boreholes during and upon completion of drilling. Boreholes 1 and 2 were each instrumented with a 50 mm diameter standpipe piezometer. Summarized below are the groundwater levels that were measured on separate visits after the completion of drilling.

Borehole ID	Date	Water Levels	
		Depth (m)	Elevation (masl)
BH1	May 17, 2021 May 25, 2021	3.7 3.8	191.6 191.5
BH2	May 17, 2021 May 25, 2021	5.6 5.7	188.6 188.5

The readings taken in the piezometers are stabilised water levels. However, the groundwater level can be expected to fluctuate seasonally and after severe weather events. As part of the study, water levels were measured in Thurber's BRDG-01 and BRDG-02, but were not relied upon as the well depths were measured to be 11.3 m and 9.6 m, respectively, compared to Thurber's reported well installation depths of 15.2 m and 13.7 m. Historical water levels at the two monitoring wells were measured by Thurber at 187.8 masl in BRDG-01 and 189.9 masl in BRDG-02.

3.8 Aquifer Performance Tests

The hydraulic conductivities of the subsurface soil surrounding the screened monitoring well zones were estimated based on single well response tests. This test involves the rapid removal of water or addition of a "slug" which displaces a known volume of water, from a single well and then monitoring the water level in the well until the well has recovered. This test was carried out in BH1 and BH2. The single well response test data were analysed using the Bouwer and Rice method and the results of the analysis are presented in Appendix E. The hydraulic conductivities of the strata are:

Borehole ID	Well Screen Elevation	Screened Formation	Hydraulic Conductivity (m/s)
BH1	189.2 to 186.2	Sandy Silt to Silt and Sand	$2.13 \times 10^{-7}\pm$
BH2	188.1 to 185.1	Silty Sand	$1.06 \times 10^{-6}\pm$

Documented values within Freeze and Cherry (1979)[1] for typical hydraulic conductivity of the investigated strata are:

- Gravelly Sand (Fill) 10^{-3} m/s to 10^{-5} m/s
- Silty Sand to Sandy Silt 10^{-4} m/s to 10^{-7} m/s

The hydraulic conductivity of the subsurface soils at the Site was also estimated using grain size analysis. The estimated hydraulic conductivities are provided in the following table.

[1] Freeze, R. A. and Cherry, J. A. (1979). *Groundwater*. Published by Prentice Hall.

Location	Estimated Groundwater Elevation (m)	Estimated Hydraulic Conductivity (m/s)
BH1	191.7	$1 \times 10^{-7}\pm$
BH2	188.6	$4.2 \times 10^{-6}\pm$

Based on a review of the hydraulic conductivities calculated from the rising head test and grain size analysis and comparison to the published values associated with the geological material tested, a design hydraulic conductivity of $2.13 \times 10^{-7}\pm$ was utilised for the sandy silt to silty sand soils for the purpose of dewatering calculations.

3.9 Groundwater Quality Assessment

A set of unfiltered groundwater sample was collected by Terraprobe and analyzed by SGS, Canada, a laboratory accredited by CALA, the Canadian Association for Laboratory Accreditation. The samples were collected directly from monitoring well BH2 on July 19, 2021.

The samples were analyzed for the following parameters:

- Provincial Water Quality Objectives (PWQO)

The exceedances with respect to PWQO criteria, are presented in table below. A copy of the Certificate of Analysis and a chain of custody record for the sample are included in Appendix F.

Parameter	Unit	BH2 Groundwater Quality Results	Provincial Water Quality Objective Limits	RDL *
Cobalt	µg/L	0.925	**0.9**	0.004
Copper	µg/L	4.3	**1**	0.2
Iron	µg/L	1960	**300**	7
Lead	µg/L	1.17	**1**	0.01
Phosphorous	mg/L	0.080	**0.01**	0.003

*Reported Detection Limit

Exceedances for Cobalt, Copper, Iron, Lead and Phosphorous were detected in groundwater samples obtained from BH2. If the short-term dewatering effluent is intended to be discharged to any surface water body, pre-treatment will be required to reduce the elevated parameters to meet compliance with the PWQO criteria.

3.10 Site Inspection to Assess Hydrogeological Features

A detailed inspection of the Site was conducted on April 13, 2021 to assess the presence of features that are significant from a hydrogeological view point. In particular, the Site was inspected to assess the following:

- The presence of drainage features or depressions that may allow for ponding and significant or enhanced water infiltration.

- Areas of seasonally high groundwater levels and/or water courses that may receive groundwater discharge and seepage.

The results of the inspection indicate that there is a watercourse crossing within the Site, below the bridge which drains into the Wye Marsh. Terraprobe expects that the water level in the watercourse will vary seasonally and with storm events. The topography of Old Fort Road generally slopes towards the north and the Trans Canada Trail topography generally slopes to the east. The forward slopes at each bridge abutment extend downwards towards the paved Trans Canada Trail. It is anticipated that surface water runoff from the road and the bridge flows towards the north and off the embankment side slopes towards the watercourse located beneath the bridge. The areas surrounding the Site are covered with vegetation and domestic wells were observed during the site reconnaissance, but no access was provided.

4.0 DISCUSSION AND ANALYSIS

4.1 Summary of Hydrogeological Conditions

The results of the investigation indicate the following hydrogeological features:

- Private potable water supply wells exist within the study area.
- The northern extent of the Site and the study area are noted to be within a SGRA, indicating that aquifer recharge in the area is dependent on rainfall infiltration.
- Soils at the Site can be characterized as deposits of fill overlying a thin layer of clayey silt overlying silty sand to sandy silt deposits.
- Stabilized groundwater levels at the Site were observed at an elevation of 191.6 masl (depth of 3.7 m below existing grade) at the north section of the Site and at an elevation of 188.7 masl (depth of 5.6 m below existing grade) at the southern section of the Site.
- Based on a review of the in-situ test results, the grain size analysis and published hydraulic conductivities for the investigated soils, the hydraulic conductivity considered for sandy silt to silty sand soils is 2.13 x 10^{-7} m/s.

4.2 Construction Details

Spread footing construction details for the new bridge are tabulated below.

Footing ID	Location	Ground Surface Elevation (masl)	Estimated Excavation Base Elevation (masl)	Design Groundwater Elevation (masl)
North	10+566.295	193.707	At or below 186.875	188.6
South	10+596.295	194.485	At or below 187	191.6

The footings will be constructed in open cut excavations with a maximum excavation side slope geometry of 1H:1V as per the geotechnical recommendations in Thurber's report. Horizontal over-excavations, at the excavation base, of up to 2.0 m in plan area were considered to facilitate footing construction and it was assumed that surface water within the watercourse will be protected and cut off from construction activities or temporarily diverted via a temporary culvert/cofferdam.

The footing data used for dewatering assessments are provided in the following table.

Footing ID	Width (m)	Length (m)	Plan Area of Excavation (m^2)
North	20	15.2	304
South	28	17.8	498.4

4.3 Construction Dewatering Volumes

Based on the excavation geometries as well as the subsurface soil and groundwater data, dewatering volumes were calculated based on the assumption that the groundwater table will be drawn down and maintained at a depth of 0.5 m below the base of excavations to permit construction in reasonably dry conditions. The dewatering conditions are summarized in the following table:

Footing ID	Location	Design Groundwater Elevation (masl)	Bottom of Excavation (masl)	Dewatering Groundwater Target (masl)
North	10+566.295	191.6	186.875	186.375
South	10+596.295	191.6	187	186.5

Numerical analysis was conducted for the short-term dewatering scenario utilizing Slide 7.014, released March 30, 2016 and developed by Rocscience Inc. This computer software programme utilizes the finite element numerical modelling method. The estimated discharge quantity for short-term (construction) dewatering assumes simultaneous construction of both bridge footings and that the watercourse flowing underneath the bridge would be cut off from construction activities or temporarily diverted via temporary culvert/cofferdam arrangements.

The short-term control of groundwater should take into account storm water management from rainfall events which will have to be removed from open excavations. A 37 mm design 2-year storm event is used in the analysis based on information obtained from the Ontario Ministry of Transportation's (MTO) IDF curve lookup tool and data for the Site.

The estimated dewatering volume for simultaneous abutment excavations is approximately 29,500 L/day and the precipitation from a 2-year design storm event is approximately 86,500 L/day. Therefore, it is estimated that the total dewatering volume is 116,000 L/day.

As required by Ontario Regulation 63/16, a plan for discharge must consider the conveyance of storm water from a 100-year storm. The additional volume that will be generated in the occurrence of a 100-year storm event is approximately 233,000 L/day.

Based on the estimated dewatering volume, a posting to the MECP Environmental Activity and Sector Registry (EASR) will be required. Posting to the EASR is required for construction dewatering activities ranging from 50,000 L/day to less than 400,000 L/day.

4.4 Assessment of Potential Impacts

4.4.1 Zone of Influence

The conceptual Zone of Influence (ZOI) for dewatering, also known as Radius of Influence (R_0), was calculated based on the anticipated maximum drawdown required and the geometric mean hydraulic conductivity. The following equation (Sichardt's equation) was used.

Equation: $R_0 = 3000*dH*K^{0.5}$

Where R_0 is the radius of influence
dH is the drawdown (m)
K is the hydraulic conductivity (m/s)

The calculated ZOI for short-term (construction) for each footing excavation is approximately ±15 m. The zone of influence is expected to be of limited extent and does not include structures, buildings and associated private servicing (i.e. private water supply wells and septic beds). The watercourse noted within the Site is within the zone of influence. Dewatering activities may affect the water level within the watercourse in the short term and monitoring is recommended prior to, during and post dewatering to ensure minimal impacts to the watercourse.

Potential sources of contamination were not noted within the anticipated zone of influence (i.e. underground fuel tanks, dry cleaning operations, fuel storage). Due to the presence of a watercourse and the classification of the northern bounds of the Site as a SGRA, dewatering and construction practices should adhere to the requirements of the Clean Water Act.

4.4.2 Geotechnical Considerations

The Site is located partially within a rural area consisting largely of vegetated fields. The anticipated zone of influence for the surrounding area in which dewatering will occur is not expected to include existing structures and buildings.

Settlement of structures and underground services are not expected to be a major concern because of the limited extent of the zone of influence of the expected dewatering works and the lack of structures and underground services within the zone of influence. The potential for settlement and ground loss can be mitigated by ensuring that the dewatering system is designed to preclude the transport and removal of sediment and fine soils.

4.4.3 Surface Water, Wetlands and Areas of Natural Significance

A watercourse to Wye Marsh crosses the Site and as indicated previously, the groundwater control activities will result in localized drawdown of the groundwater table. Since tributary crossings are situated within the zone of influence, there is a potential that the nearby surface water features will be affected by the dewatering activities. Monitoring of surface water bodies is recommended during construction and mitigation measures (such as reducing the discharge rate, installing a barrier along the perimeter of the excavation to reduce effects on the groundwater, halting dewatering to assess whether the water body will recover, etc.) should be implemented if significant impacts are observed within surface water bodies. Monitoring should include visual inspections, total suspended solids, water depths, and flow rates.

There is also a potential for the surface water to contribute to additional dewatering volumes due to higher infiltration rates near the water course. Since the aquifer to be dewatered is unconfined, the additional contribution of water may affect the dewatering volume substantially during precipitation events. Groundwater is also expected to flow towards the watercourse within the Site locally and north towards Georgian Bay regionally. It is expected that the majority of surface run-off will be directed to the watercourse.

4.4.4 Local Wells and Zone of Influence

Local municipal and/or private wells were not identified within the expected zone of influence of dewatering works. The dewatering zone of influence is expected to be minimal and will not impact wells that may be present in the vicinity of the Site.

4.5 Construction Issues

It is recommended that the following issues be considered:

- Carry out an additional well survey to assess baseline water levels and groundwater quality for private water supply wells situated within a 500 m radius of the Site prior to the start of dewatering; and
- The dewatering contractor shall prepare a contingency plan to mitigate the effects of construction dewatering on nearby watercourses. The plan should include the determination of baseline water level and water quality parameters for the watercourse and continued monitoring of the watercourse as well as mitigation measures, if any effects are noted.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The following dewatering requirements are expected given the conditions for bridge replacement and improvements at the Site:

- Dewatering is anticipated to be required for both the north and south abutments footings of the proposed bridge and it is envisaged that open cut excavations will be required extending to undisturbed competent native soils.
- The estimated water taking volume from excavations required to install the north and south footings simultaneously is approximately 29,500 L/day. The dewatering system should also be designed to accommodate a typical 2-year design storm event (37 mm rainfall event) which will generate approximately 86,500 L/day, hence resulting in a total anticipated dewatering volume of approximately 116,000 L/day.
- Construction dewatering activities will require a posting to the Ontario Ministry of the Environment Conservation and Parks (MECP) Environmental Activity and Sector Registry (EASR). Posting to the EASR is required for construction dewatering activities where the dewatering volume is more than 50,000 L/day and less than 400,000 L/day.
- Construction dewatering activities will not require an application to the Ontario Ministry of the Environment Conservation and Parks (MECP) for a Permit to Take Water (PTTW). A PTTW is only required for dewatering volumes that exceed 400,000 L/day.
- The dewatering zone of influence is approximately ±15 m measured horizontally from the perimeter of open excavations. Potential sources of contamination are not expected within dewatering zones of influence.

In addition to the foregoing the following issues should be considered prior to and during construction.

- The design of a dewatering system and associated sediment control plan is the contractor's responsibility. It is anticipated that dewatering can be achieved by pumping from strategically placed filtered sumps within the base of excavations. The contractor shall also take into consideration pretreatment of the groundwater prior to discharge.

- Survey private wells within the study area to assess baseline water levels and groundwater quality within a 500 m radius of the Site prior to the start of dewatering; and
- Measurement of water level and water quality parameters for the watercourse prior to and during dewatering and the development of a contingency plan to mitigate the effects of dewatering, if any.

6.0 LIMITATIONS AND RISK

6.1 Procedures

This investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by Terraprobe and other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The discussions and recommendations that have been presented are based on the factual data obtained by Terraprobe.

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing program implemented in accordance with the most stringent level of care may fail to detect certain conditions. Terraprobe has assumed for the purposes of providing design parameters and advice, that the conditions that exist between sampling points are similar to those found at the sample locations. The conditions that Terraprobe has interpreted to exist between sampling points can differ from those that actually exist.

It may not be possible to drill a sufficient number of boreholes or sample and report them in a way that would provide all the subsurface information that could affect construction costs, techniques, equipment, and scheduling. Contractors bidding on or undertaking work on the project should be directed to draw their own conclusions as to how the subsurface conditions may affect them, based on their own investigations and their own interpretations of the factual investigation results, cognizant of the risks implicit in the subsurface investigation activities so that they may draw their own conclusions as to how the subsurface conditions may affect them.

6.2 Changes in Site and Scope

It must also be recognized that the passage of time, natural occurrences, and direct or indirect human intervention at or near the Site have the potential to alter subsurface conditions. Groundwater levels are particularly susceptible to seasonal fluctuations.

The discussion and preliminary recommendations are based on the factual data obtained from investigations made by Terraprobe and are intended for use by the owner and its retained designers in the design phase of the project. If there are changes to the project scope and development features the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructability issues and quality control may not be relevant or complete for the revised project. Terraprobe should be retained to review the implications of such changes with respect to the contents of this report.

Terraprobe Inc.

Mariam Al Gailani, E.I.T.

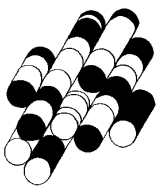
Amar Neku, Ph.D., P.Eng., P.Geo.

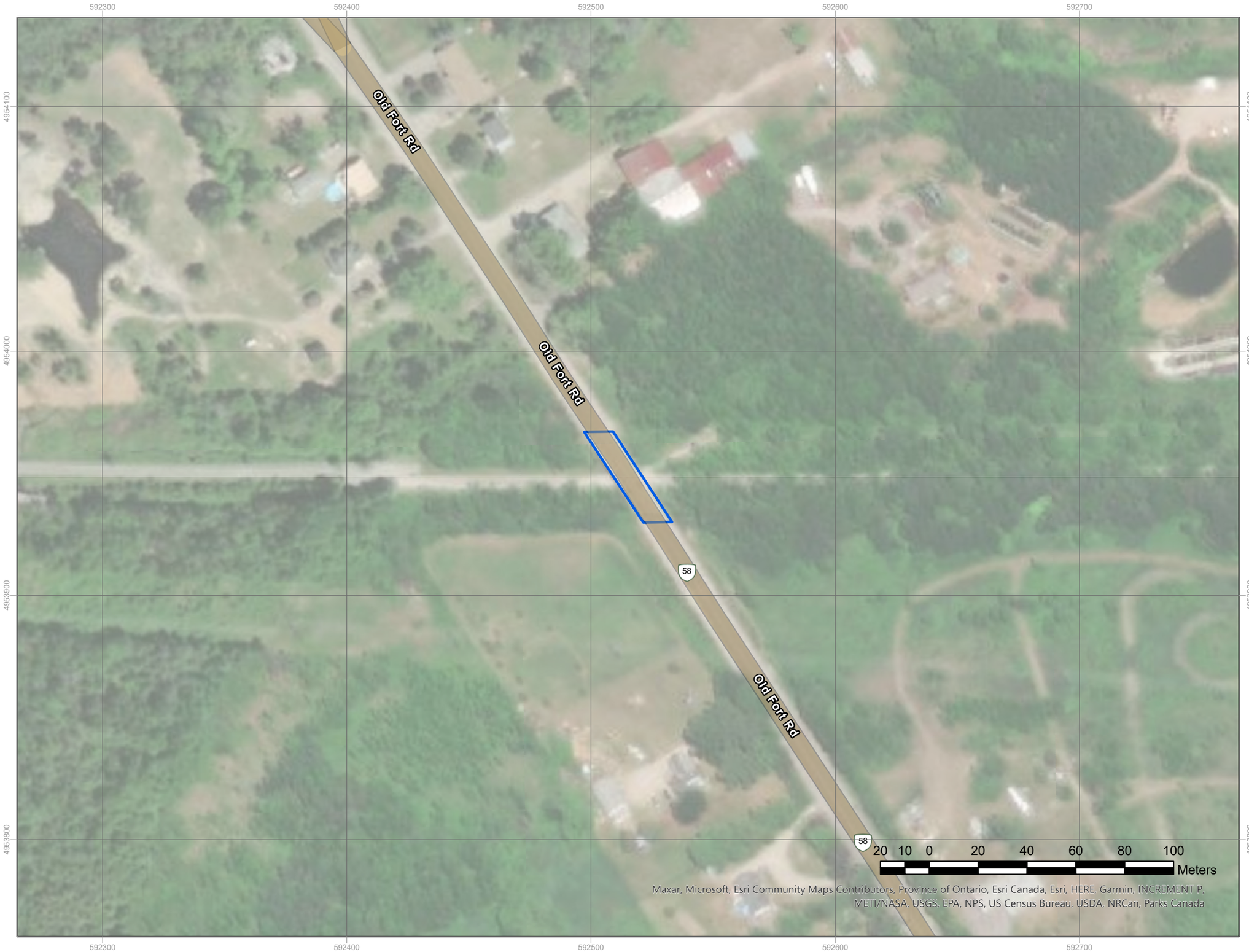
Dr. Giorgio Garofalo, P.Geo., QP_{ESA}
Sr. Hydrogeologist / Sr. Project Manager

Rehman Abdul, P.Eng.
Principal

FIGURES

TERRAPROBE INC.





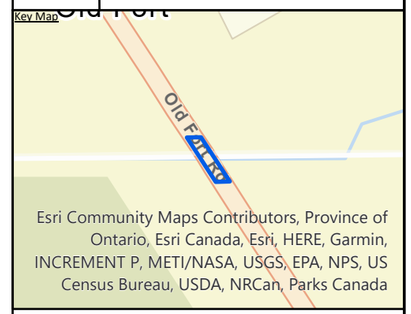
Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing

N W E S

References:

ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/ Airbus Ds, USDA, USGS, AeroGRID, IGN, and the GIS User Community.Basemaps

Key Map



Notes:

Legend:

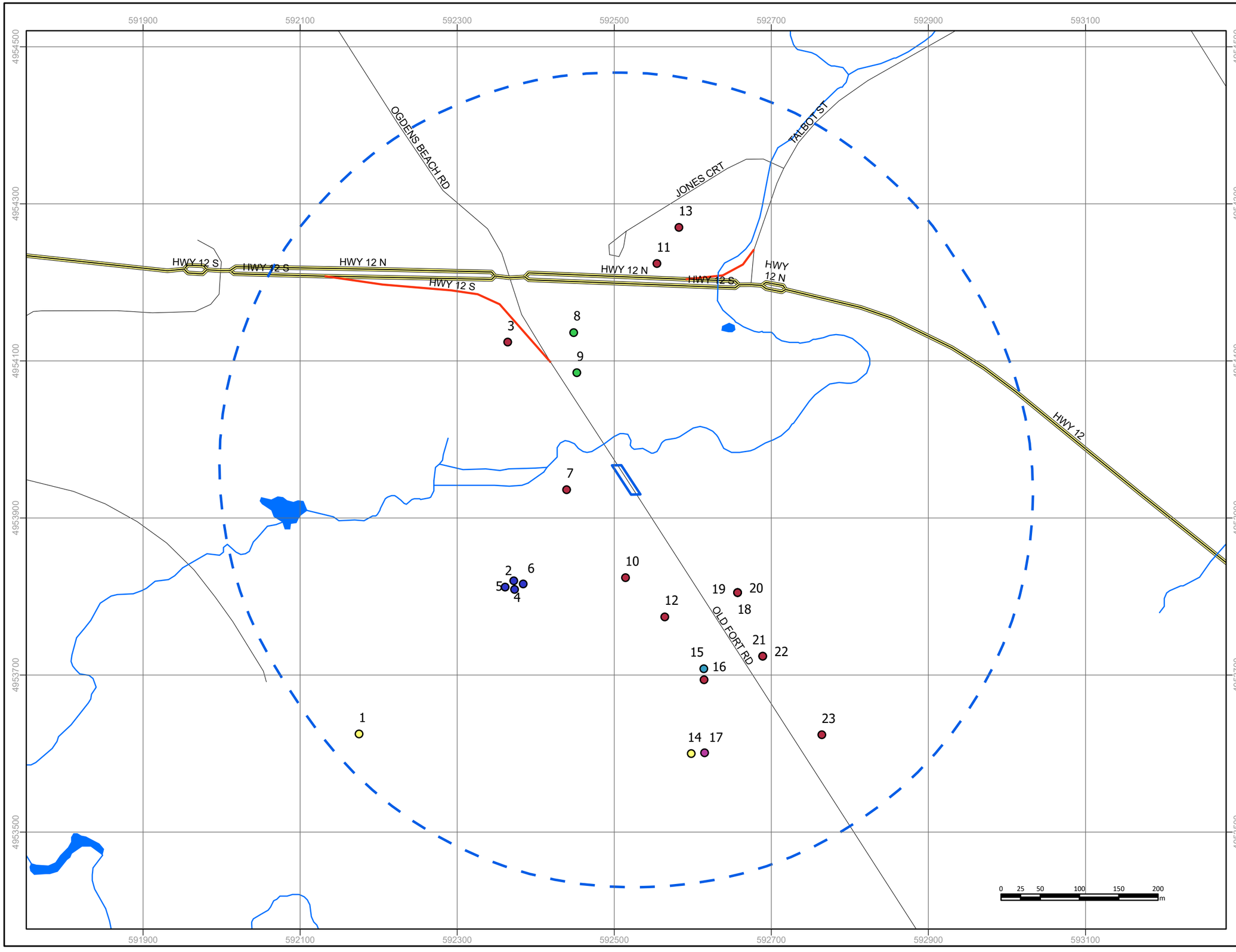
Approximate Site Boundary

Project Title:
Old Fort Road Bridge Replacement
Hydrogeological Assessment

Site Location:
Old Fort Road, Ontario

Figure Title:
Site Location Plan

Designed By: MA	*File No.:* 1-21-0168-11
Drawn By: SSK	*Scale:* As Shown
Reviewed By: RA	*Figure No.:* 1
Date: June 2021	



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing

N W E S

References:

ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus Ds, USDA, USGS, AeroGRID, IGN, and the GIS User Community produced by Terraprobe Inc. Copyright (c) Queen's Printer 2020. Water Well Information System Ministry of the Environment, Conservation and Parks, 2020

Notes:

Legend:

- Approximate Site Boundary
- Approximate Study Area, 500m
- Water Course
- Collector
- Expressway / Highway
- Local / Street
- Ramp
- Unknown
- Abandoned-Supply
- Alteration
- Monitoring and Test Hole
- Observation Wells
- Water Supply

Project Title:
Old Fort Road Bridge Replacement
Hydrogeological Assessment

Site Location:
Old Fort Road, Ontario

Figure Title:
MECP Well Records Map

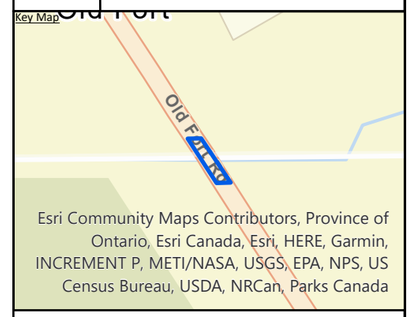
Designed By: MA	*File No.:* 1-21-0168-11
Drawn By: SSK	*Scale:* As Shown
Reviewed By: RA	*Figure No.:* 2
Date: June 2021	

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing

References:

ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/ Airbus Ds, USDA, USGS, AeroGRID, IGN, and the GIS User Community.Basemaps

Key Map



Notes:

Legend:

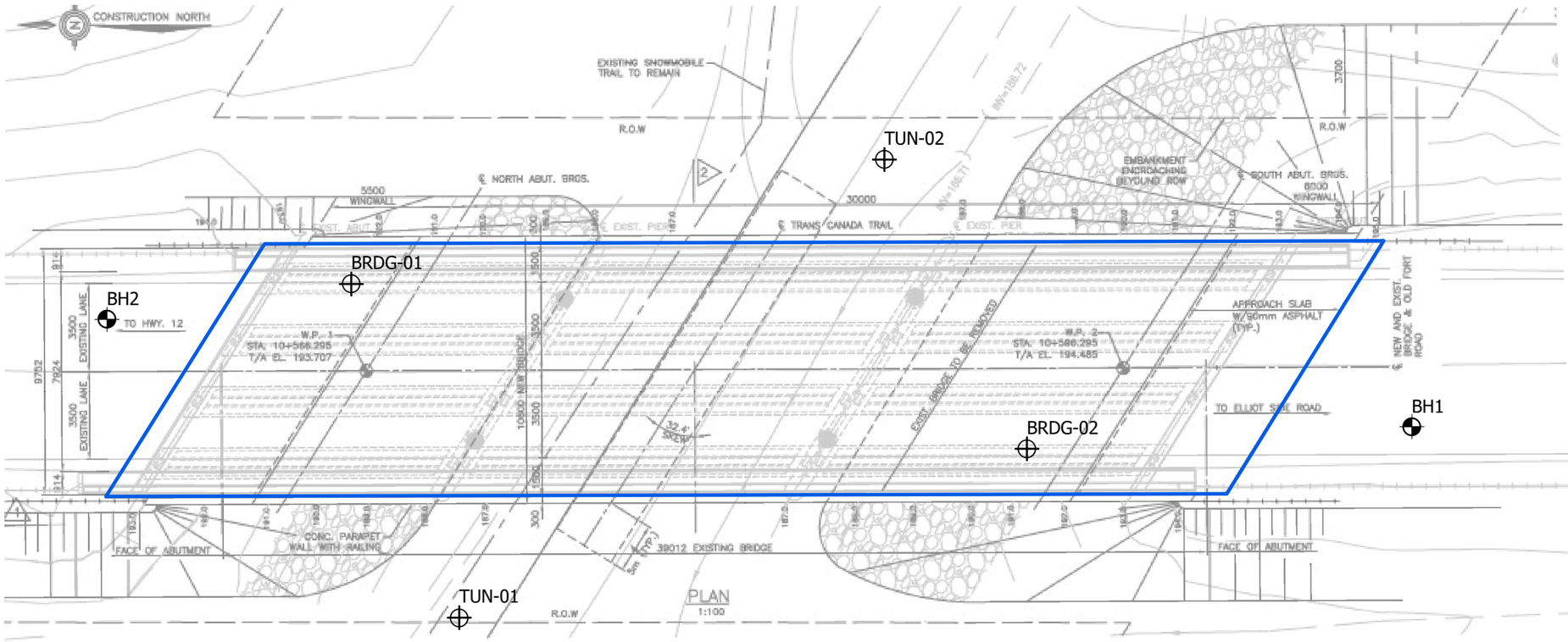
- Approximate Site Location
- Borehole Location; Terraprobe
- Borehole Location; Thruber

Project Title:
Old Fort Road Bridge Replacement
Hydrogeological Assessment

Site Location:
Old Fort Road, Ontario

Figure Title:
Borehole and Monitoring Well Plan

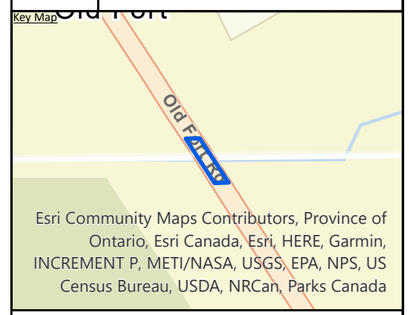
Designed By: MA	*File No.:* 1-21-0168-11
Drawn By: SSK	*Scale:* As Shown
Reviewed By: RA	*Figure No.:* 3
Date: June 2021	



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing

References:
Old Fort Road Bridge
Date: Jan 2021
Dwg 1

Key Map



Notes:

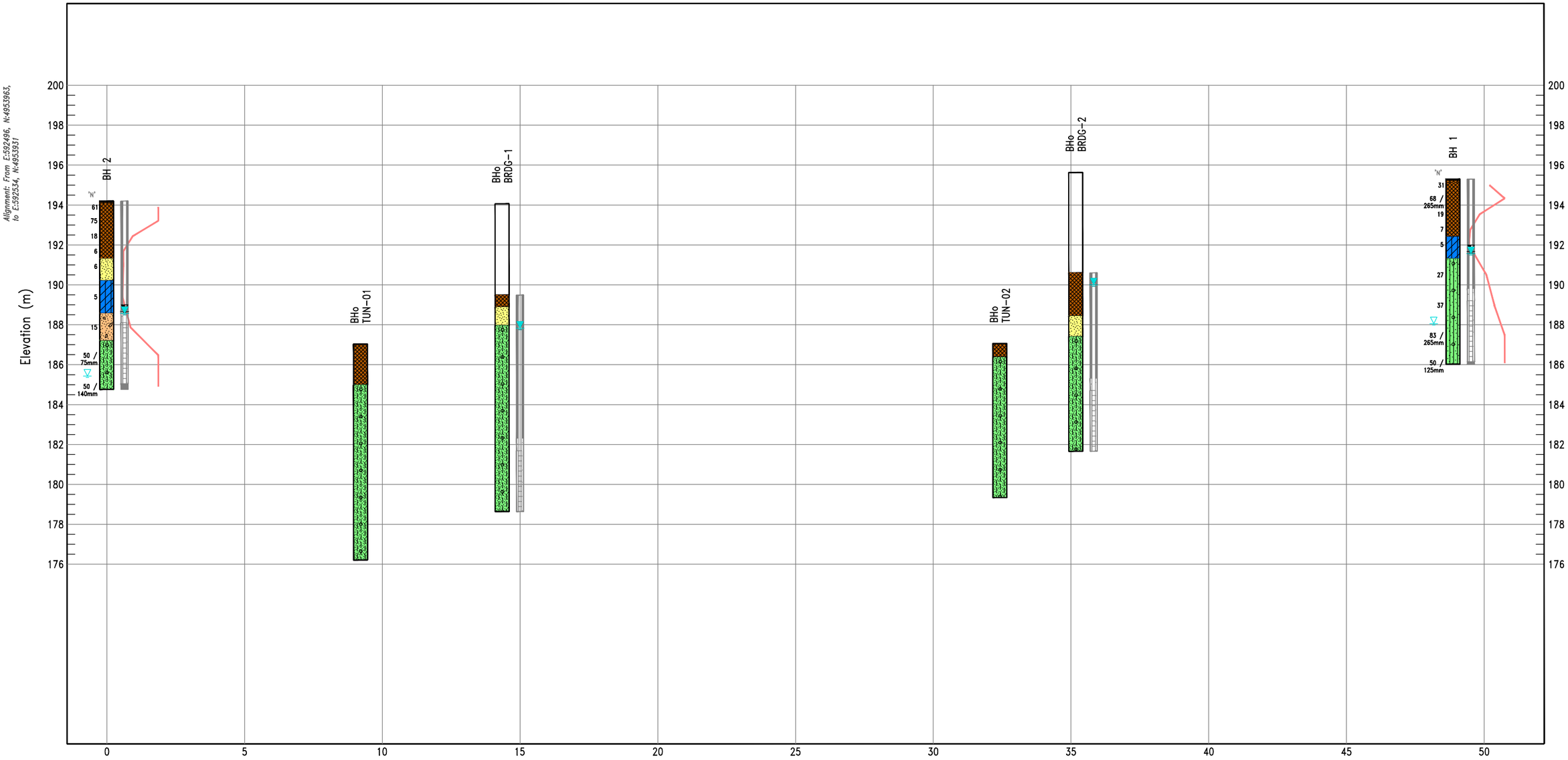
Legend:
- Approximate Site Location
- Borehole Location; Terraprobe
- Borehole Location; Thruber

Project Title:
Old Fort Road Bridge Replacement
Hydrogeological Assessment

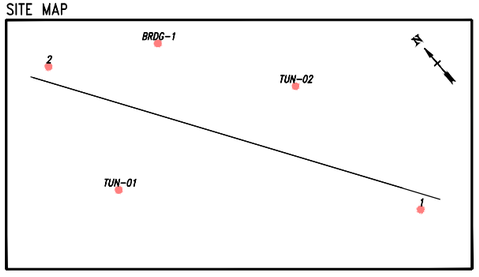
Site Location:
Old Fort Road, Ontario

Figure Title:
Borehole and Monitoring Well Plan

Designed By: MA	*File No.:* 1-21-0168-11
Drawn By: SSK	*Scale:* As Shown
Reviewed By: RA	*Figure No.:* 4
Date: June 2021	



SITE MAP



LITHOLOGY GRAPHIC LEGEND

- Asphalt
- Fill
- Clay and Silt
- Sandy Silt Till
- Sand
- Gravelly Sand
- Silty Sand Till
- Blank

INTERPRETIVE LEGEND

- WL on completion of drilling
- Stabilized WL, most recent

- FILL
- GRAVELS (gravel to gravelly sand)
- SILT TO SAND (not till)
- COHESIONLESS TILLS
- COHESIVE SOILS (clayey silt to clay, incl. tills)
- DISTURBED/REWORKED SOILS

HORIZ. SCALE 1 0 1 2m

VERT. SCALE 1 0 1 2m

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

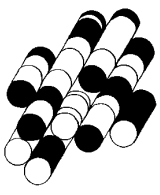
Title: STRATIGRAPHIC PROFILE

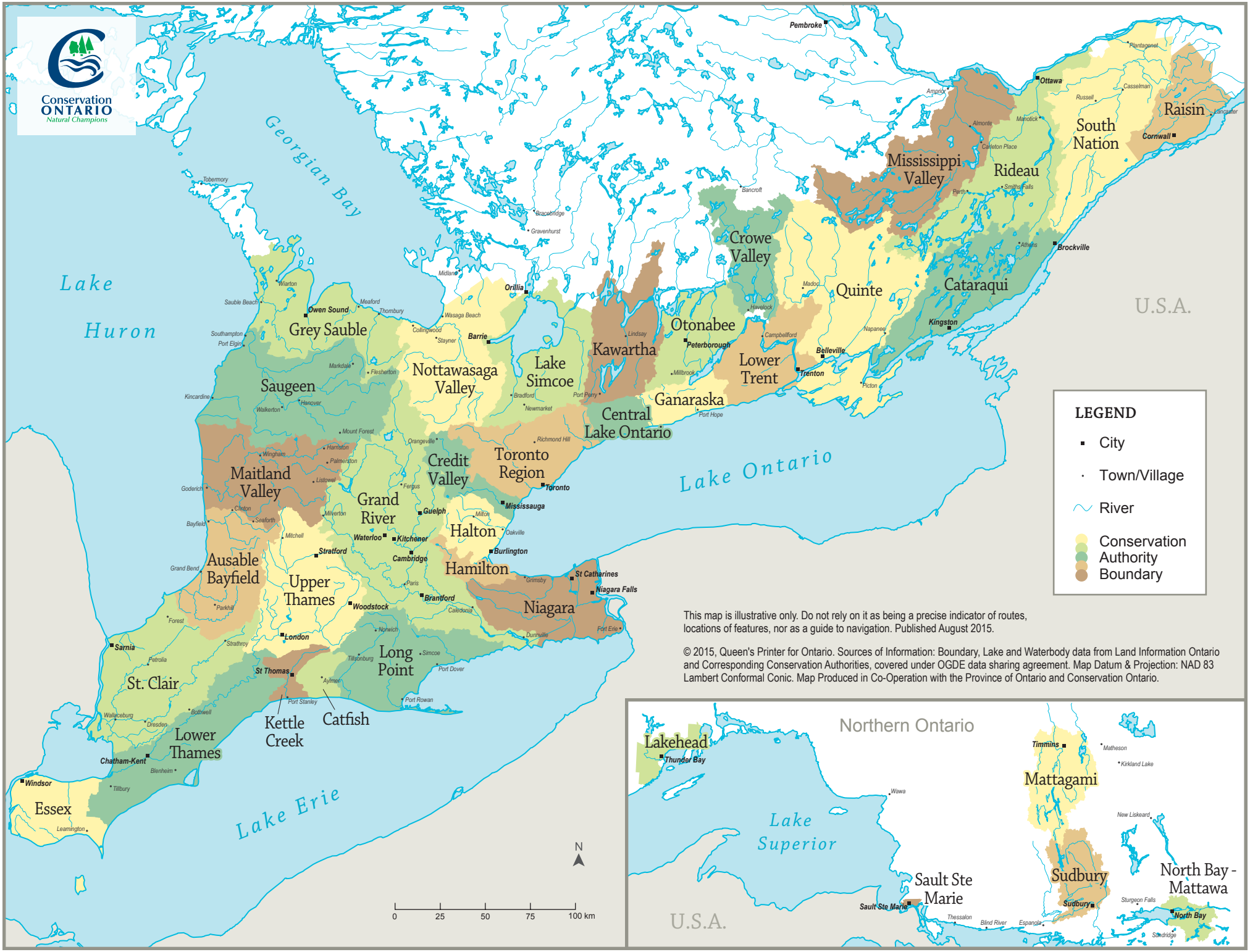
File No.: 1-21-0168-11

FIGURE: 5

APPENDIX A

TERRAPROBE INC.




Conservation ONTARIO
Natural Champions
Georgian Bay
Lake Huron
Lake Ontario
Lake Erie
U.S.A.
Grey Sauble
Saugeen
Nottawasaga Valley
Lake Simcoe
Kawartha
Crowe Valley
Otonabee
Quinte
Cataraqui
Lower Trent
Ganaraska
Central Lake Ontario
Toronto Region
Credit Valley
Maitland Valley
Grand River
Halton
Hamilton
Niagara
Ausable Bayfield
Upper Thames
Long Point
St. Clair
Kettle Creek
Catfish
Lower Thames
Essex
Mississippi Valley
Rideau
South Nation
Raisin
LEGEND
City
Town/Village
River
Conservation Authority Boundary
N
0 25 50 75 100 km
This map is illustrative only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation. Published August 2015.
© 2015, Queen's Printer for Ontario. Sources of Information: Boundary, Lake and Waterbody data from Land Information Ontario and Corresponding Conservation Authorities, covered under OGDE data sharing agreement. Map Datum & Projection: NAD 83 Lambert Conformal Conic. Map Produced in Co-Operation with the Province of Ontario and Conservation Ontario.
Northern Ontario
Lake Superior
U.S.A.
Lakehead
Sault Ste Marie
Mattagami
Sudbury
North Bay - Mattawa

Hydrologic Features

Legend

Terraprobe Inc.

3,669.0 0 1,834.49 3,669.0 Metres

1: 72,224

Map Compiled by the Oak Ridges Moraine Groundwater Program.101 Exchange Avenue, Vaughan, Ontario, M3N 1S4

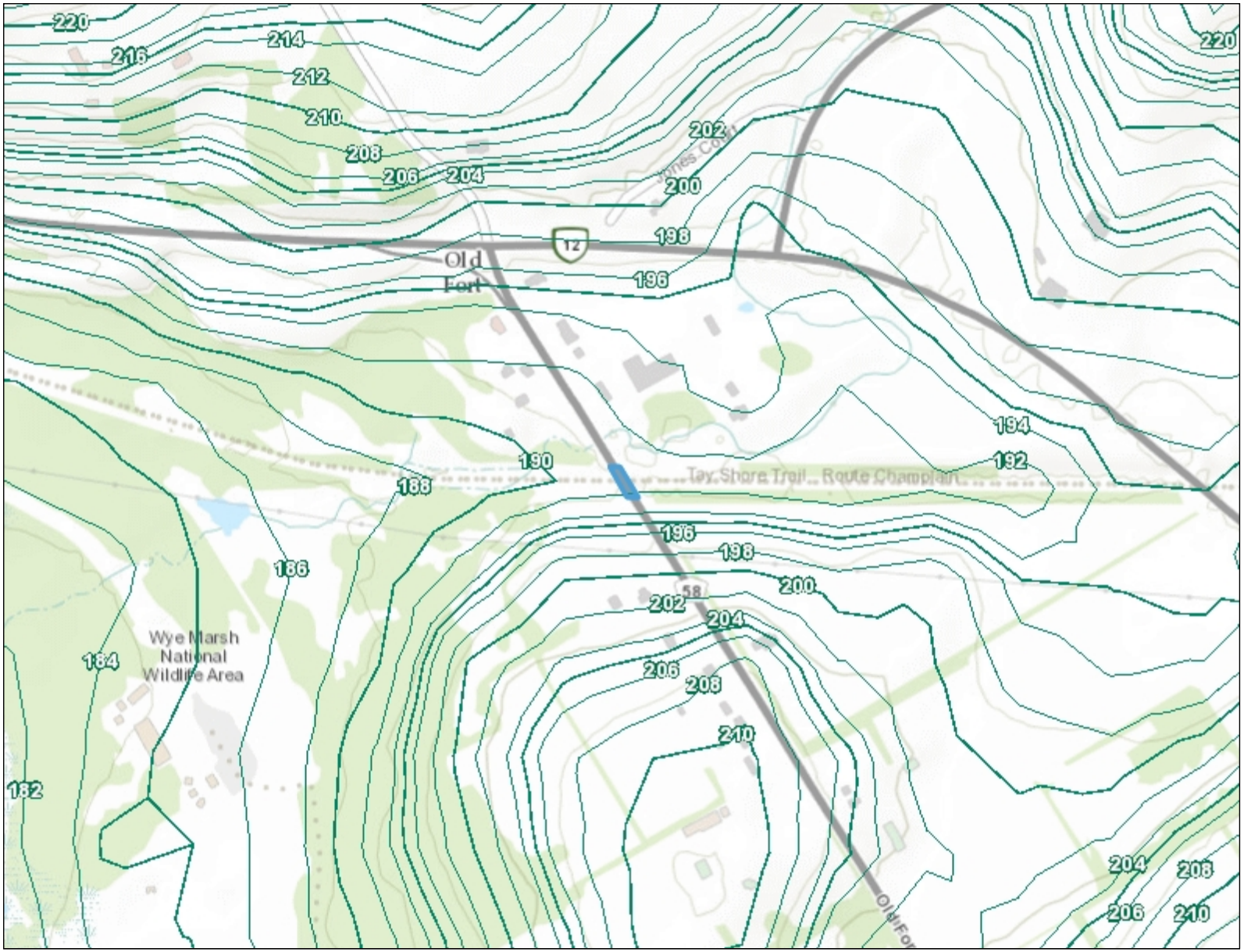
This map is for information purposes only and the Oak Ridges Moraine Groundwater Program takes no responsibility for, nor guarantees, the accuracy of all the information contained within the map.

SOURCE: ORMGP2021; MNRF2021;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: June 4, 2021

Topography



Legend

- Contour_5m_ORMGP_DEM100_i
- Contour_2m_ORMGP_DEM100_j

Terraprobe Inc.

458.6 0 229.31 458.6 Metres

1: 9,028

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SOURCE: ORMGP2021; MNRF2021;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: June 4, 2021

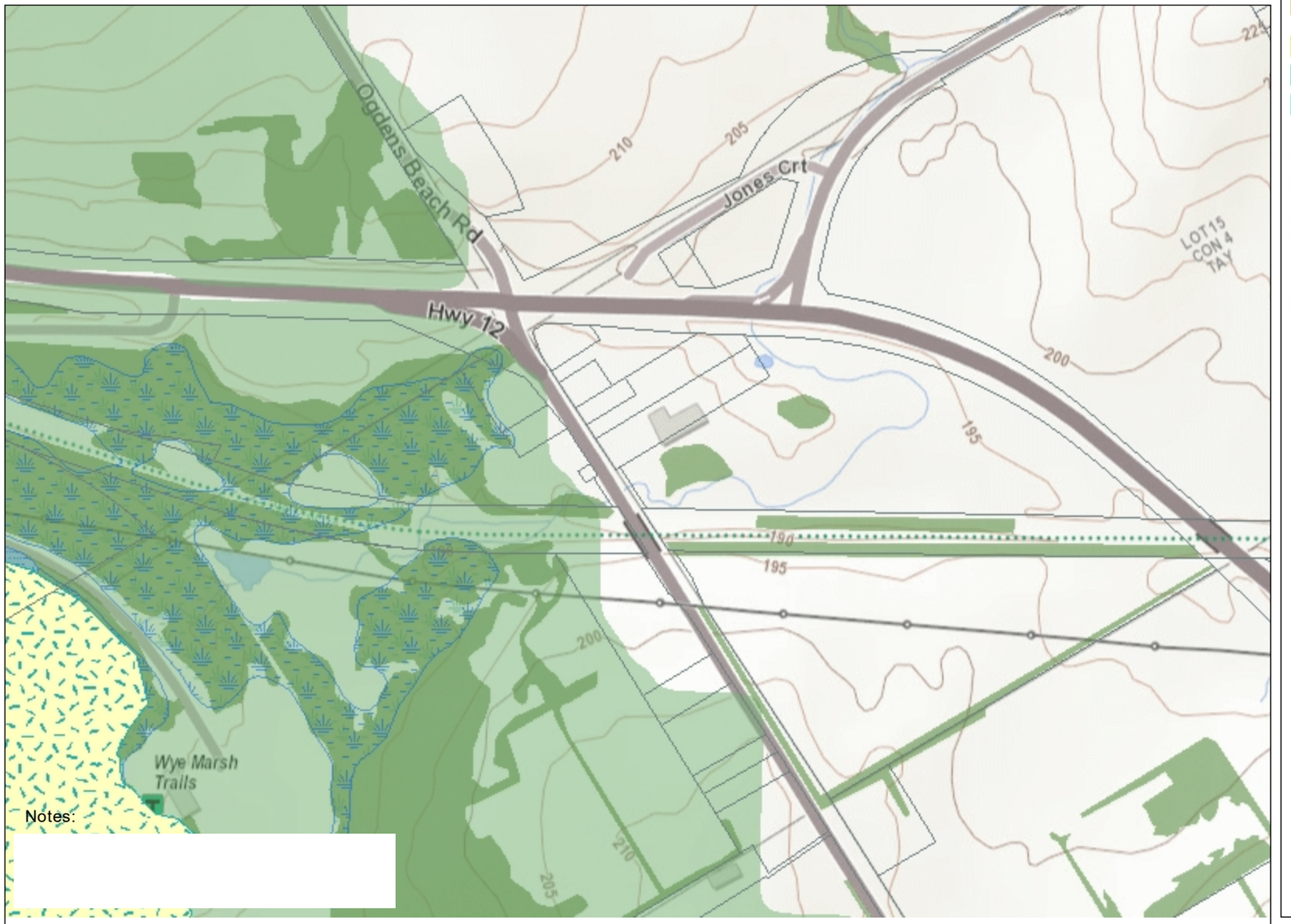
Ontario

Ministry of Natural Resources and Forestry

Make-a-Map: Natural Heritage Areas

MNRF - Natural Heritage Areas

Map created:6/2/2021



Legend

- Assessment Parcel
- ANSI
- Earth Science Provincially Significant/sciences de la terre d'importance provinciale
- Earth Science Regionally Significant/sciences de la terre d'importance régionale
- Life Science Provincially Significant/sciences de la vie d'importance provinciale
- Life Science Regionally Significant/sciences de la vie d'importance régionale
- Evaluated Wetland
- Provincially Significant/considérée d'importance provinciale
- Non-Provincially Significant/non considérée d'importance provinciale
- Unevaluated Wetland
- Woodland
- Conservation Reserve
- Provincial Park
- Natural Heritage System

0.3 0 0.16 0.3 Kilometres

Absence of a feature in the map does not mean they do not exist in this area.

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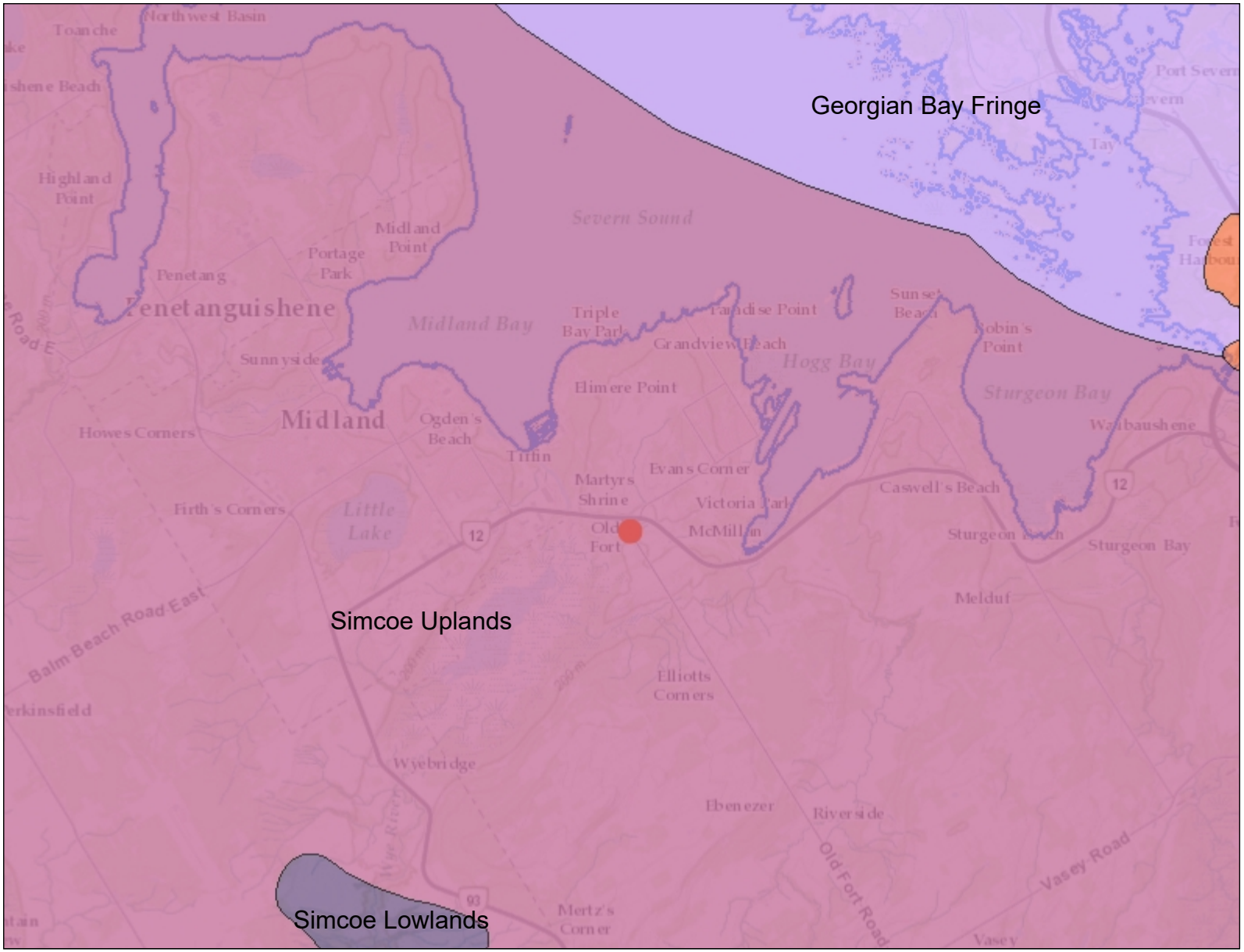
Surficial Geology



Legend

- CAMC Boundary
- OGS_Physiographic_Regions
  - Algonquin Highlands
  - Beaver Valley
  - Carden Plain
  - Dummer Moraines
  - Dundalk Till Plain
  - Flamborough Plain
  - Georgian Bay Fringe
  - Guelph Drumlin Field
  - Hillsburgh Sandhills
  - Horseshoe Moraines
  - Iroquois Plain
  - Napanee Plain
  - Niagara Escarpment
  - Number 11 Strip
  - Oak Ridges Moraine
  - Peel Plain
  - Peterborough Drumlin Field
  - Prince Edward Peninsula
  - Schomberg Clay Plains
  - Simcoe Lowlands
  - Simcoe Uplands
  - South Slope
  - Stratford Till Plain

Terraprobe Inc.

7,337.9 0 3,668.97 7,337.9 Metres

1: 144,448

Map Compiled by the Oak Ridges Moraine Groundwater Program.101 Exchange Avenue, Vaughan, Ontario, M3N 1S4

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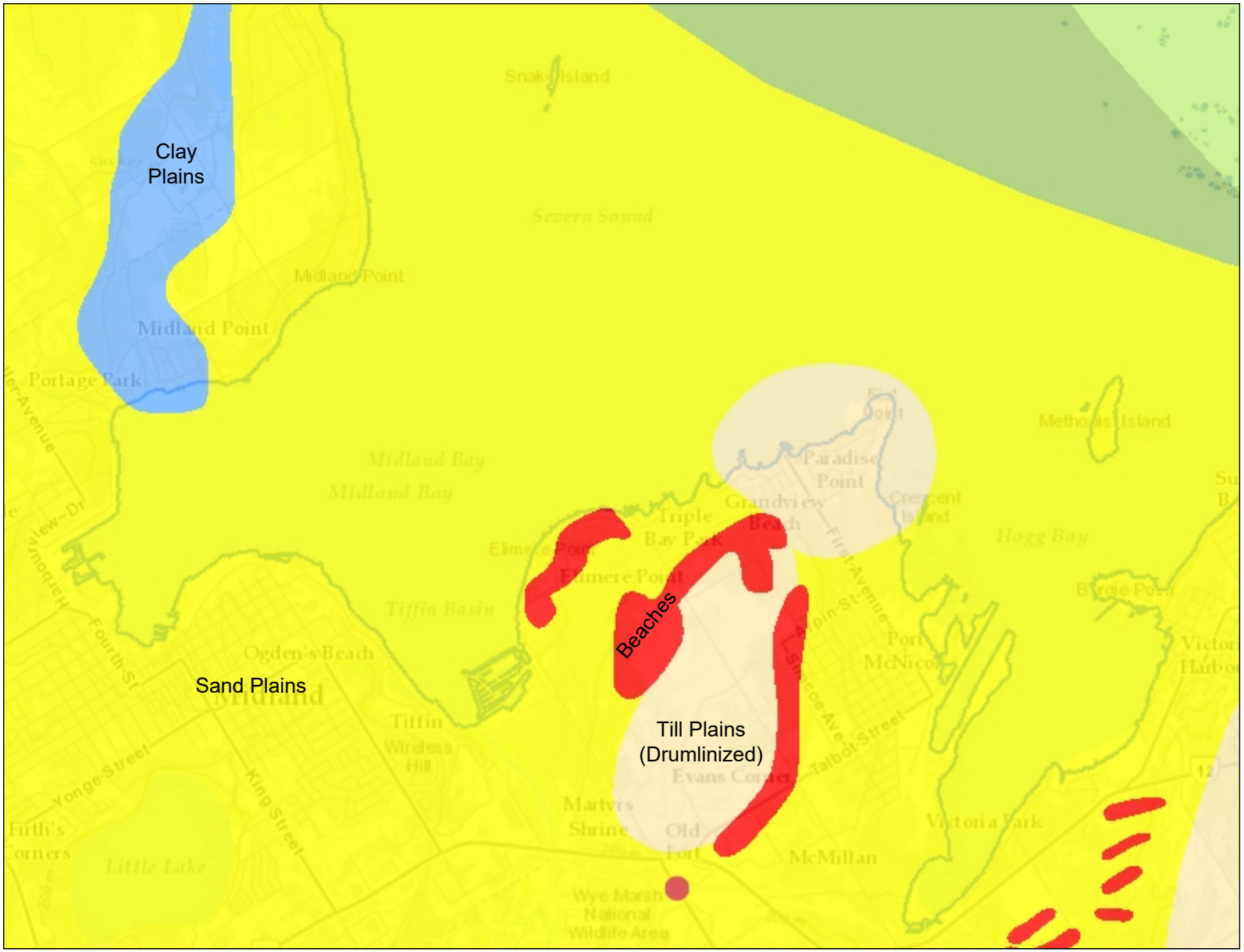
SOURCE: ORMGP2021; MNRF2021;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: July 7, 2021

Regional Physiography



Legend

- CAMC Boundary
- OGS_Physiography
  - Bare Rock Ridges And Shallow Till
  - Beaches
  - Bevelled Till Plains
  - Clay Plains
  - Drumlins
  - Escarpments
  - Eskers
  - Kame Moraines
  - Limestone Plains
  - Peat And Muck
  - Sand Plains
  - Shale Plains
  - Shallow Till And Rock Ridges
  - Spillways
  - Till Moraines
  - Till Plains (Drumlinized)
  - Till Plains (Undrumlinized)

Terraprobe Inc.

3,669.0 0 1,834.49 3,669.0 Metres

1: 72,224

Map Compiled by the Oak Ridges Moraine Groundwater Program.101 Exchange Avenue, Vaughan, Ontario, M3N 1S4

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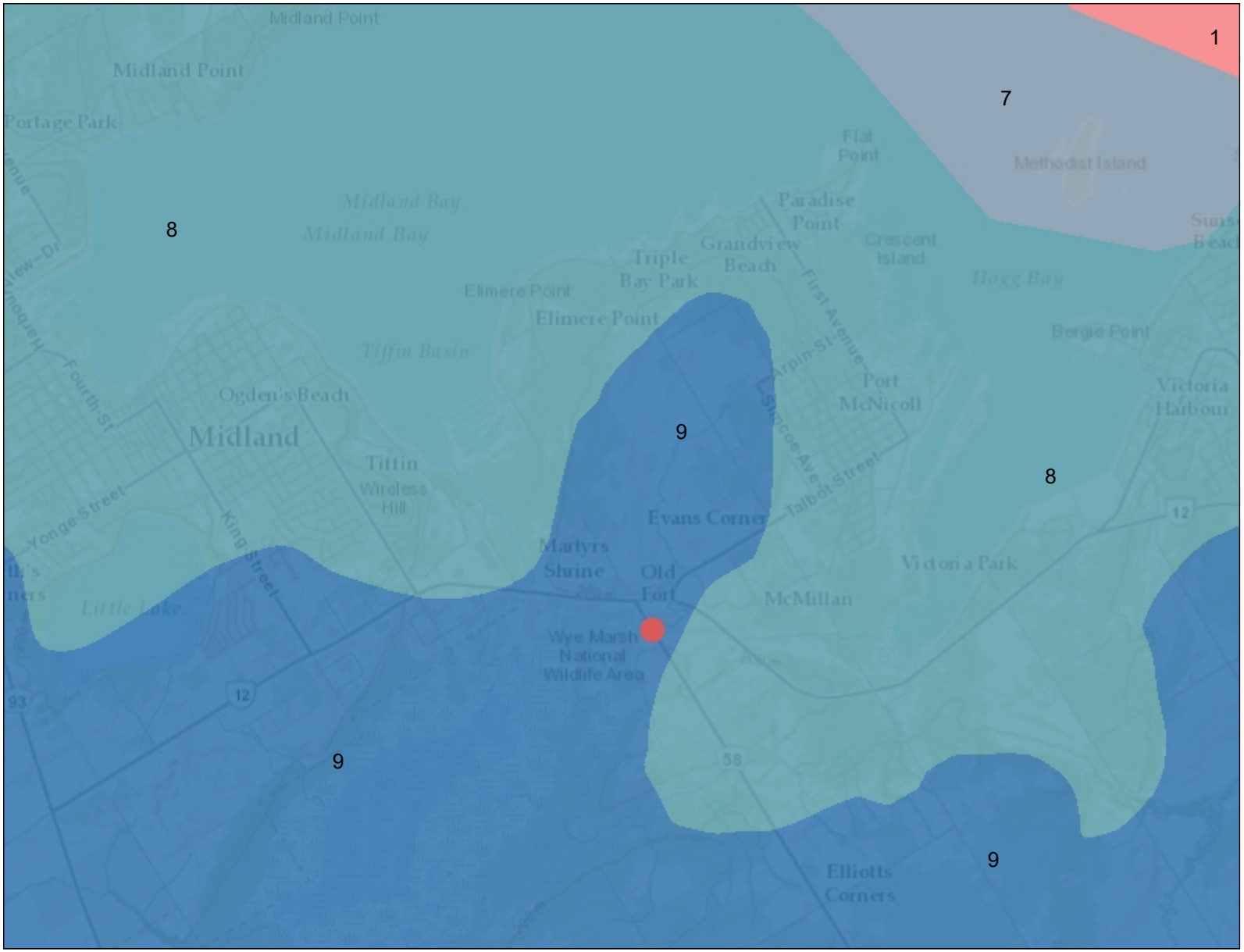
SOURCE: ORMGP2021; MNRF2021;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: July 7, 2021

Boreholes



Legend

Bedrock Geology (OGS)

- 33: Port Lambton Group
- 32: Kettle Point
- 31: Hamilton Group
- 30: Marcellus
- 29: Dundee
- 28: Lucas
- 27: Amherstburg
- 26: Onondaga
- 25: Bois Blanc
- 24: Oriskany
- 23: Bass Islands
- 22: Bertie
- 21: Salina
- 20: Guelph
- 19: Amabel
- 18: Lockport
- 17: Clinton-Cataract Group
- 16: Queenston
- 15: Carlsbad
- 14: Georgian Bay
- 13: Billings
- 12: Blue Mountain
- 11: Lindsay
- 10: Verulam
- 9: Bobcaygeon
- 8: Gull River
- 7: Shadow Lake
- 6: Rockcliffe
- 5: Oxford
- 4: March
- 3: Nepean
- 2: Covey Hill
- 1: Precambrian

Terraprobe Inc.

3,669.0 0 1,834.49 3,669.0 Metres

1: 72,224

Map Compiled by the Oak Ridges Moraine Groundwater Program.101 Exchange Avenue, Vaughan, Ontario, M3N 1S4

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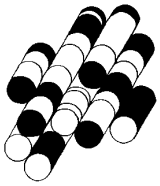
SOURCE: ORMGP2021; MNRF2021;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: July 7, 2021

APPENDIX B

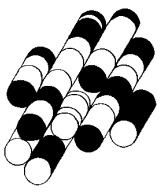
TERRAPROBE INC.



WELL_ID	BORE_HOLE_ID	x	y	ELEVATION	Final_Status	Use1	Use2	DATE_COMPLETED	Water_Found_Depth_M	Static_Lev_M	Depth_from_M	Depth_to_M	SCRN_TOP_DEPTH_M	SCRN_END_DEPTH_M	METHOD	OTHER_METHOD	qryConstructionMethod_METHOD
7236420	1005294430	592175	4953625	187.436004	Monitoring and Test Hole	Monitoring and Test Hole		12/17/2014							Direct Push		Direct Push
7308839	1007013116	592361	4953812		Observation Wells	Monitoring		2/21/2018			0	4.5	1.5	4.5	Boring		Boring
5713597	10391338	592364.3	4954124	193.872177	Water Supply	Domestic		8/15/1976	17.08	1.83					Cable Tool		Cable Tool
7308838	1007013113	592372	4953820		Observation Wells	Monitoring		2/21/2018			0	4.5	1.5	4.5	Boring		Boring
7308840	1007013119	592373	4953809		Observation Wells	Monitoring		2/21/2018			0	4.199999809	1.200000048	4.199999809	Boring		Boring
7308863	1007013188	592384	4953816		Observation Wells	Monitoring		2/22/2018			0	4.5	1.5	4.5	Boring		Boring
5703922	10381812	592439.3	4953936	191.114318	Water Supply	Domestic		2/11/1967	30.805	8.235			30.195	31.11	Cable Tool		Cable Tool
5726593	10404178	592448.3	4954136	194.443145	Abandoned-Supply	Domestic		4/9/1990	71.675	13.725					Rotary (Air)		Rotary (Air)
5726594	10404179	592452.3	4954085	192.752502	Abandoned-Supply	Domestic		4/18/1990	28.06						Rotary (Air)		Rotary (Air)
5714227	10391960	592514.3	4953824	200.27452	Water Supply	Domestic		1/20/1968	83.57	21.655					Cable Tool		Cable Tool
5707646	10385486	592554.3	4954224	198.577621	Water Supply	Domestic		8/12/1970	46.055	5.185					Cable Tool		Cable Tool
5710921	10388735	592564.3	4953774	203.796264	Water Supply	Domestic		11/22/1973	100.65	25.01					Rotary (Convent.)		Rotary (Convent.)
5726389	10403977	592582.3	4954270	198.93338	Water Supply	Domestic		2/12/1990	34.16	16.775					Rotary (Air)		Rotary (Air)
7236417	1005294421	592598	4953600	211.330078	Monitoring and Test Hole	Monitoring and Test Hole		12/17/2014							Direct Push		Direct Push
7274405	1006287976	592614	4953708	209.896881	Alteration	Domestic		9/14/2016							Other Method	WELDER	Other Method
5707707	10385546	592614.3	4953694	210.354263	Water Supply	Domestic		9/23/1970	25.315	14.335			25.315	26.23	Cable Tool		Cable Tool
7220634	1004771766	592615	4953601	211.386917				10/18/2013									
7050575	23050575	592657	4953805	204.040802	Water Supply	Domestic		7/30/2007	85	18.5	25	85			Rotary (Convent.)		Rotary (Convent.)
7050575	23050575	592657	4953805	204.040802	Water Supply	Domestic		7/30/2007	85	18.5	7	25			Rotary (Convent.)		Rotary (Convent.)
7050575	23050575	592657	4953805	204.040802	Water Supply	Domestic		7/30/2007	85	18.5	0	7			Rotary (Convent.)		Rotary (Convent.)
7050574	23050574	592689	4953724	206.961151	Water Supply	Domestic		6/29/2007	12		0	6			Rotary (Convent.)		Rotary (Convent.)
7050574	23050574	592689	4953724	206.961151	Water Supply	Domestic		6/29/2007	12		6	14			Rotary (Convent.)		Rotary (Convent.)
5708634	10386463	592764.3	4953624	206.098495	Water Supply	Domestic		9/24/1971	16.775	10.065					Cable Tool		Cable Tool
5711160	10388968	592864.3	4953474	200.589996	Water Supply	Domestic		5/27/1974	7.625	4.27			9.15	10.065	Cable Tool		Cable Tool

APPENDIX C

TERRAPROBE INC.



LOG OF BOREHOLE 1

Terraprobe

Project No. : 1-21-0168-11	Client : Lea Consulting Ltd	Originated by : OH
Date started : May 7, 2021	Project : Old Fort Road	Compiled by : MA
Sheet No. : 1 of 1	Location : Simcoe County	Checked by : RA

Position : E: 592528.0, N: 4953925.0 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Hollow stem augers

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE
195.3	**GROUND SURFACE**				
195.1 / 0.2	65mm **ASPHALTIC CONCRETE**		1	SS	31
	65mm **FILL**, sand and gravel				
	FILL, sand, some silt, some gravel, trace rock fragments, trace asphalt, very dense to compact, dark brown, moist to wet		2	SS	68 / 265mm
			3	SS	19
	...gravelly sand, trace rock fragments, loose		4	SS	7
192.4 / 2.9	**CLAYEY SILT to SILTY CLAY**, firm, brown, moist		5	SS	5
191.3 / 4.0	**SANDY SILT to SILT AND SAND**, trace gravel, trace clay, compact to very dense, grey, wet (GLACIAL TILL)		6	SS	27
			7	SS	37
			8	SS	83 / 265mm
186.0 / 9.3	...trace rock fragments		9	SS	50 / 125mm

GROUND WATER CONDITIONS

ELEVATION SCALE: 195, 194, 193, 192, 191, 190, 189, 188, 187

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
1	41	52	6

END OF BOREHOLE

Monitoring well installation consists of a 50mm diameter schedule 40 PVC pipe with a 3.0m slotted screen.

Unstabilized water level measured at 7.3 m below ground surface; borehole was open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 17, 2021	3.7	191.6
May 25, 2021	3.8	191.5

+ ^{3}, × ^{3}: Numbers refer to Sensitivity ○ $^{3\%}$ STRAIN AT FAILURE

file: 1-21-0168-11 bh logs.gpj

LOG OF BOREHOLE 2

Terraprobe

Project No. : 1-21-0168-11	Client : Lea Consulting Ltd	Originated by : OH
Date started : May 7, 2021	Project : Old Fort Road	Compiled by : MA
Sheet No. : 1 of 1	Location : Simcoe County	Checked by : RA

Position : E: 592503.0, N: 4953971.0 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Hollow stem augers

ELEV DEPTH (m)	DESCRIPTION	NUMBER	TYPE	SPT 'N' VALUE
194.2	**GROUND SURFACE**			
194.0 / 0.2	100mm **ASPHALTIC CONCRETE** 65mm **FILL**, sand and gravel	1	SS	61
	FILL, gravelly sand, trace to some rock fragments, trace silt, very dense to compact, brown, moist to wet	2	SS	75
		3	SS	18
	...sand, some silt seams, some clay, brown	4	SS	6
191.3 / 2.9	**SAND**, some silt, trace gravel, loose, brown, wet	5	SS	6
190.2 / 4.0	**CLAYEY SILT to SILTY CLAY**, soft, brown, moist	6	SS	5
188.6 / 5.6	**GRAVELLY SAND**, some silt, compact, grey, wet	7	SS	15
187.2 / 7.0	**SILTY SAND**, trace clay, trace gravel, very dense, grey, wet (GLACIAL TILL)	8	SS	50 / 75mm
184.8 / 9.4	...silt and sand	9	SS	50 / 140mm

END OF BOREHOLE

Monitoring well installation consists of a 50mm diameter schedule 40 PVC pipe with a 3.0m slotted screen.

Unstabilized water level measured at 8.8 m below ground surface; borehole was open upon completion of drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

sampler wet at 3.0m

18 61 18 3

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 17, 2021	5.6	188.6
May 25, 2021	5.7	188.5

+ 3, × 3 : Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

file: 1-21-0168-11 bh logs.gpj

RECORD OF BOREHOLE BRDG-01

PROJECT : Old Fort Overhead Bridge Replacement
LOCATION : County of Simcoe, Ontario
STARTED : May 28, 2020
COMPLETED : May 28, 2020
N 4 953 964.0 E 592 515.9

Project No. 28556
SHEET 1 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		194.06							
		CONCRETE (BRIDGE DECK): (225mm)		0.00							
		AIR		0.23							
1											
2											
3											
4											
				189.49							
5	Hollow Stem Augers	**SAND**, some gravel, trace silt, very loose, brown, moist: (FILL)		4.57	1	SS	1				Stick-Up Well Protector Set In Concrete
				188.86							
		SAND, silty, some gravel to gravelly, compact, grey, moist to wet, with occasional silt seams		5.20	2	SS	17	Grain Size Analysis: Gr 24%/ Sa 52%/ Si 20%/ Cl 4%			
6				187.97							
		SILT, sandy to **SAND**, silty, trace to some gravel and clay, very dense, grey, moist, with cobbles and boulders: (TILL)		6.10	3	SS	100/ 0.150				
7					4	SS	63				
					5	SS	100/ 0.300				
8											Bentonite
9					6	SS	100/ 0.200	Grain Size Analysis: Gr 7%/ Sa 43%/ Si 46%/ Cl 4%			

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

May 30, 2020

LOGGED : MP
CHECKED : KF

THURBER

THURBER2S TEL-28556.GPJ 7/24/20

RECORD OF BOREHOLE BRDG-01

PROJECT : Old Fort Overhead Bridge Replacement
LOCATION : County of Simcoe, Ontario
STARTED : May 28, 2020
COMPLETED : May 28, 2020
N 4 953 964.0 E 592 515.9

Project No. 28556
SHEET 2 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10											
11					7	SS	100/ 0.250				
12	Hollow Stem Augers				8	SS	55				Filter Sand
13											
14					9	SS	73	Grain Size Analysis: Gr 14%/ Sa 58%/ Si 23%/ Cl 5%			Slotted Screen
15											
				178.65	10	SS	100/ 0.175				
				15.42							
16		END OF BOREHOLE AT 15.42m. Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.									
17		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) May 28/20 12.25 181.81 May 30/20 6.30 187.76									
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER May 30, 2020

LOGGED : MP
CHECKED : KF

THURBER

THURBER2S TEL-28556.GPJ 7/24/20

RECORD OF BOREHOLE BRDG-02

PROJECT : Old Fort Overhead Bridge Replacement
LOCATION : County of Simcoe, Ontario
STARTED : May 30, 2020
COMPLETED : May 30, 2020
N 4 953 927.7 E 592 512.3

Project No. 28556
SHEET 1 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤ rem V - ● Q - ✖ Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp w wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		195.63							
		CONCRETE (BRIDGE DECK): (225mm)		0.00							
		AIR		0.23							
1											
2											
3											
4											
5	Hollow Stem Augers			190.60							
		SAND, some gravel, trace silt, loose to very loose, brown, moist, occasional organic inclusions: (FILL)		5.03	1	SS	8		○		Stick-Up Well Protector Set In Concrete ▼
6					2	SS	2		○		
7					3	SS	21	Grain Size Analysis: Gr 23%/ Sa 35%/ Si 35%/ Cl 7%	○		▽
		SAND, silty, some gravel to gravelly, compact, grey, wet, occasional silt seams		188.43 7.20							Bentonite
8					4	SS	22		○		
		SILT, sandy to **SAND**, silty, trace to some gravel and clay, very dense, grey, moist, occasional cobbles and boulders: (TILL)		187.37 8.25	5	SS	76		○		
9					6	SS	52	Grain Size Analysis: Gr 1%/ Sa 36%/ Si 56%/ Cl 7%	○		

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

May 30, 2020

LOGGED : MP
CHECKED : KF

THURBER

THURBER2S TEL-28556.GPJ 7/24/20

RECORD OF BOREHOLE BRDG-02

PROJECT : Old Fort Overhead Bridge Replacement
LOCATION : County of Simcoe, Ontario
STARTED : May 30, 2020
COMPLETED : May 30, 2020
N 4 953 927.7 E 592 512.3

Project No. 28556
SHEET 2 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	Hollow Stem Augers							20 40 60 80 100			Filter Sand
11					7	SS	102/ 0.275				
12		Numerous cobbles from 11.7 to 13.3m									
13	NQ Coring				8	RUN		TCR=10% SCR=10%			Slotted Screen
14	Tricone				9	SS	103/ 0.250				
15		END OF BOREHOLE AT 13.97m UPON PRACTICAL REFUSAL TO ADVANCE. WATER LEVEL AT 7.0 m UPON COMPLETION. Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.		181.66 13.97							
16		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) May 30/20 5.69 189.93									
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 30, 2020

LOGGED : MP
CHECKED : KF

THURBER

THURBER2S TEL-28556.GPJ 7/24/20

RECORD OF BOREHOLE TUN-01

PROJECT : Old Fort Overhead Bridge Replacement
LOCATION : County of Simcoe, Ontario
STARTED : May 25, 2020
COMPLETED : May 26, 2020
N 4 953 952.7 E 592 499.5

Project No. 28556
SHEET 1 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		187.03							
	Hollow Stem Augers	**SAND** and **SILT**, trace to some gravel, compact to dense, brown, moist to wet, with organic inclusions: (FILL)		0.00	1	SS	13		○		
1					2	SS	100/ 0.250	Grain Size Analysis: Gr 9%/ Sa 39%/ Si 44%/ Cl 8%	○		
2					3	SS	43		○		▽
		SILT, sandy to **SAND**, silty, trace to some gravel and clay, very dense, grey, moist, with cobbles and boulders: (TILL)		184.97 2.05							
					4	SS	100/ 0.250		○		
3					5	SS	100/ 0.250	Grain Size Analysis: Gr 2%/ Sa 38%/ Si 53%/ Cl 7%	○		
4					6	SS	100/ 0.100				
					7	SS	100/ 0.125		○		
5											
6					8	SS	100/ 0.150		○		
7											
					9	SS	100/ 0.100		○		
8		Boulder from 8.2 to 8.9m									
	NQ Coring				10	RUN		TCR=100% SCR=100%			
9					11	RUN		TCR=15% SCR=10%			

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MP
CHECKED : KF

THURBER

THURBER2S TEL-28556.GPJ 7/24/20

RECORD OF BOREHOLE TUN-01

PROJECT : Old Fort Overhead Bridge Replacement
LOCATION : County of Simcoe, Ontario
STARTED : May 25, 2020
COMPLETED : May 26, 2020

Project No. 28556
SHEET 2 OF 2
DATUM Geodetic

N 4 953 952.7 E 592 499.5

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	Tricone										
				176.20	12	SS	100/				
		END OF BOREHOLE AT 10.82m UPON PRACTICAL REFUSAL TO ADVANCE. BOREHOLE OPEN TO 7.72m AND WATER LEVEL AT 1.83m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.		10.82			0.150				
11											
12											
13											
14											
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MP
CHECKED : KF

THURBER

THURBER2S TEL-28556.GPJ 7/24/20

RECORD OF BOREHOLE TUN-02

PROJECT : Old Fort Overhead Bridge Replacement
LOCATION : County of Simcoe, Ontario
STARTED : May 26, 2020
COMPLETED : May 27, 2020
N 4 953 948.0 E 592 526.0

Project No. 28556
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		187.06							
	Hollow Stem Augers	**SAND**, some gravel to gravelly, some silt to silty, loose, brown to black, moist, with organic inclusion, occasional coal fragments: (FILL)		0.00	1	SS	6				
				186.38							
1		**SILT**, sandy to **SAND**, silty, trace to some gravel and clay, very dense, grey, ,moist, with cobbles and boulders: (TILL)		0.69	2	SS	100/ 0.250				▽
2					3	SS	100/ 0.225				
					4	SS	100/ 0.150				
3					5	SS	100/ 0.275				
4					6	SS	100/ 0.250				
					7	SS	100/ 0.225				
5											
6					8	SS	100/ 0.200				
7	Tricone										
				179.34	9	SS	100/ 0.100	Grain Size Analysis: Gr 9%/ Sa 40%/ Si 43%/ Cl 8%			
		END OF BOREHOLE AT 7.72m UPON PRACTICAL REFUSAL TO ADVANCE. BOREHOLE OPEN TO 6.10m AND WATER LEVEL AT 1.50m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.		7.72							
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

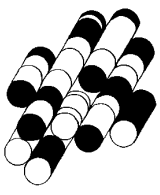
LOGGED : MP
CHECKED : KF

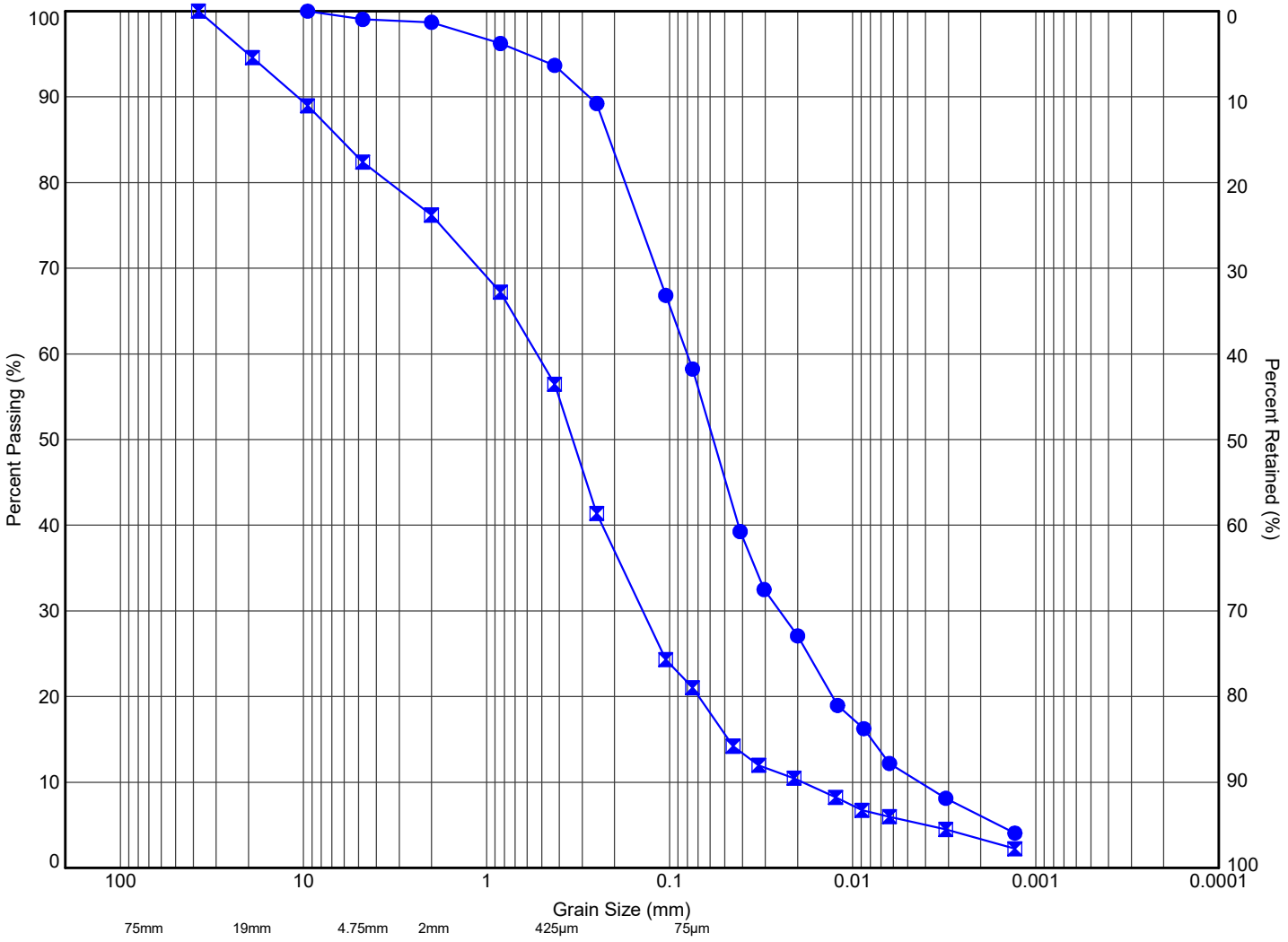
THURBER

THURBER2S TEL-28556.GPJ 7/24/20

APPENDIX D

TERRAPROBE INC.





USCS	COBBLES	GRAVEL		SAND			SILT & CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM (%)

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel	Sand	Silt & Clay
●	**1**	SS7	6.3	189.0	1	41	58
⊠	**2**	SS7	6.3	187.9	18	61	21

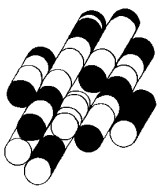
Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title: **GRAIN SIZE DISTRIBUTION**

File No.: **1-21-0168-11**

APPENDIX E

TERRAPROBE INC.



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing

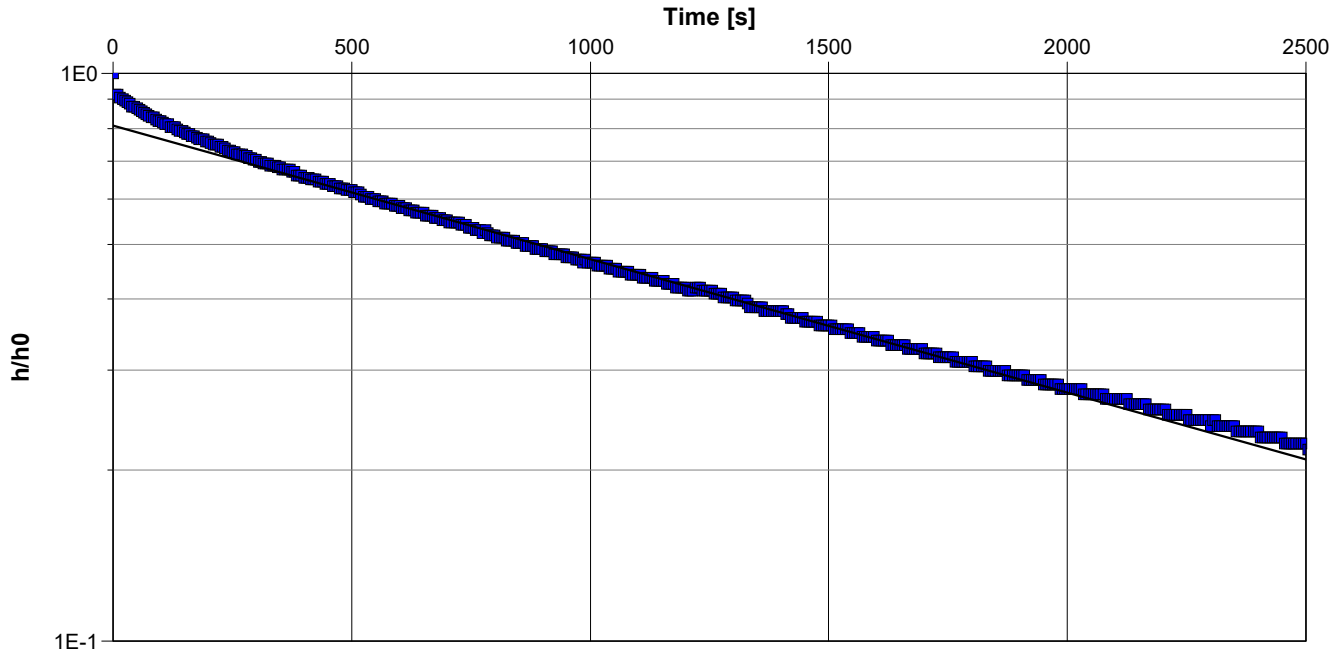
Slug Test Analysis Report

Project: Old Fort Road Bridge

Number: 1-21-0138

Client: Lea Cinsulting

Location: County of Simcoe	Slug Test: Falling Head Test	Test Well: BH1
Test Conducted by: OH		Test Date: 5/17/2021
Analysis Performed by: MA	BH1 - FHT	Analysis Date: 5/31/2021
Aquifer Thickness: 9.40 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH1	2.13×10^{-7}	

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing

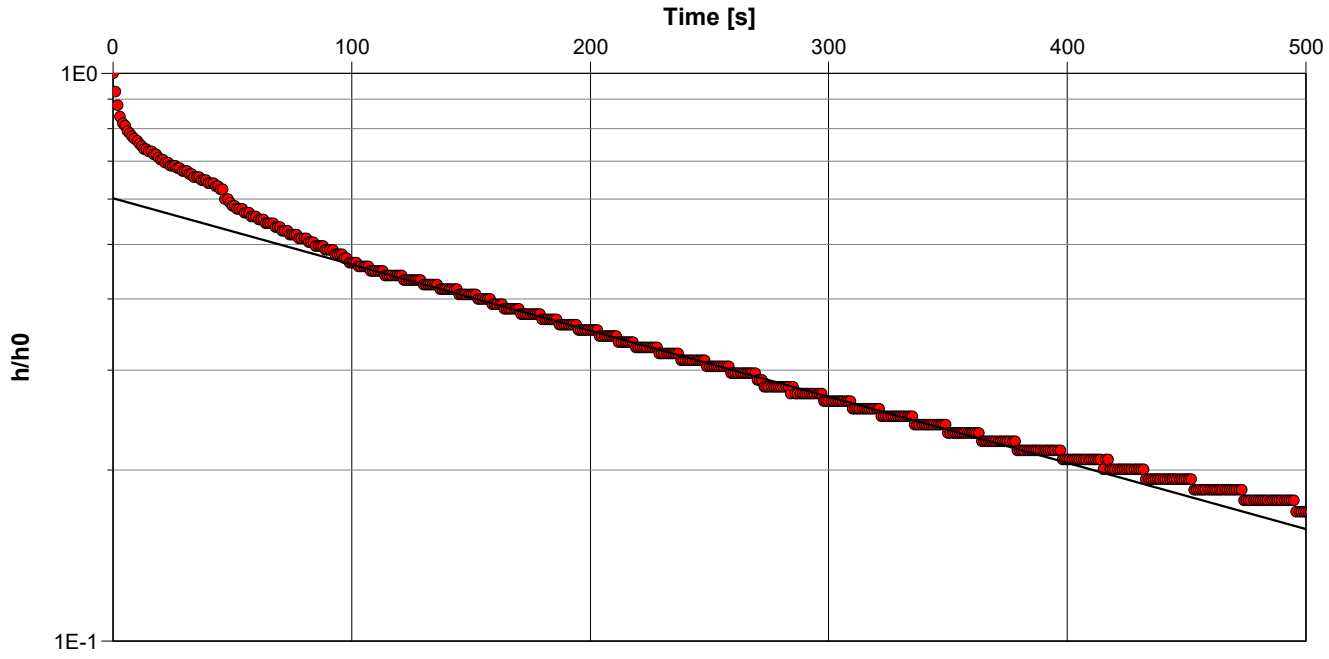
Slug Test Analysis Report

Project: Old Fort Road Bridge

Number: 1-21-0138

Client: Lea Cinsulting

Location: County of Simcoe	Slug Test: Falling Head Test	Test Well: BH2
Test Conducted by: OH		Test Date: 5/17/2021
Analysis Performed by: MA	BH2 - FHT	Analysis Date: 5/31/2021
Aquifer Thickness: 9.40 m		

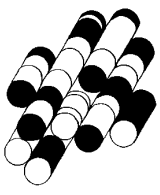


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH2	1.06×10^{-6}	

APPENDIX F

TERRAPROBE INC.



FINAL REPORT

CA14399-JUL21 R1

1-21-0168

Prepared for

Terraprobe

FINAL REPORT

CA14399-JUL21 R1

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Terraprobe	Project Specialist	Jill Campbell, B.Sc.,GISAS
		Laboratory	SGS Canada Inc.
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Mariam Al Gailani	Telephone	2165
Telephone	519-722-7134	Facsimile	705-652-6365
Facsimile	905-796-2250	Email	jill.campbell@sgs.com
Email	malgailani@terraprobe.ca	SGS Reference	CA14399-JUL21
Project	1-21-0168	Received	07/19/2021
Order Number		Approved	07/23/2021
Samples	Ground Water (1)	Report Number	CA14399-JUL21 R1
		Date Reported	07/23/2021

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
NR - Not reportable under applicable Provincial drinking water regulations as per client.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:025673

Raise RL for NO2 due to sample matrix interference

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

TABLE OF CONTENTS

Client: Terraprobe
Project: 1-21-0168
Project Manager: Mariam Al Gailani
Samplers: Syed Ali

PACKAGE: **General Chemistry** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

Sample Number	7
Sample Name	BH2
Sample Matrix	Ground Water
Sample Date	19/07/2021

Parameter	Units	RL	L1	Result
General Chemistry				
Alkalinity	mg/L as CaCO3	2		489
Bicarbonate	mg/L as CaCO3	2		489
Carbonate	mg/L as CaCO3	2		< 2
OH	mg/L as CaCO3	2		< 2
Colour	TCU	3		9
Conductivity	uS/cm	2		4660
Turbidity	NTU	0.10		34.2
Ammonia+Ammonium (N)	as N mg/L	0.04		< 0.04
Phosphorus (total reactive)	mg/L	0.03		< 0.03
Total Organic Carbon	mg/L	1		2
Metals and Inorganics				
Fluoride	mg/L	0.06		< 0.06
Bromide	mg/L	0.05		0.18
Nitrite (as N)	as N mg/L	0.003		< 0.03↑
Nitrate (as N)	as N mg/L	0.006		2.98
Sulphate	mg/L	0.04		38
Hardness	mg/L as CaCO3	0.05		1090
Aluminum (0.2µm)	mg/L	0.001	0.015	0.009
Arsenic	µg/L	0.2	5	1.1

Client: Terraprobe
Project: 1-21-0168
Project Manager: Mariam Al Gailani
Samplers: Syed Ali

PACKAGE: **Metals and Inorganics** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

Sample Number	7
Sample Name	BH2
Sample Matrix	Ground Water
Sample Date	19/07/2021

Metals and Inorganics (continued)

Parameter	Units	RL	L1	Result
Boron	µg/L	2	200	17
Barium	µg/L	0.02		569
Beryllium	µg/L	0.007	11	0.070
Cobalt	µg/L	0.004	0.9	0.925
Calcium	mg/L	0.01		366
Cadmium	µg/L	0.003	0.1	0.023
Copper	µg/L	0.2	1	4.3
Chromium	µg/L	0.08		4.35
Iron	ug/L	7	300	1960
Potassium	mg/L	0.009		4.51
Magnesium	mg/L	0.001		42.2
Manganese	µg/L	0.01		72.0
Molybdenum	µg/L	0.04	40	1.42
Nickel	µg/L	0.1	25	2.6
Sodium	mg/L	0.01		581
Phosphorus	mg/L	0.003	0.01	0.080
Lead	µg/L	0.01	1	1.17
Silicon	ug/L	20		11100
Silver	µg/L	0.05	0.1	< 0.05
Strontium	µg/L	0.02		982
Thallium	µg/L	0.005	0.3	0.024
Tin	µg/L	0.06		0.92
Titanium	ug/L	0.05		113

Client: Terraprobe
Project: 1-21-0168
Project Manager: Mariam Al Gailani
Samplers: Syed Ali

PACKAGE: **Metals and Inorganics** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

Sample Number	7
Sample Name	BH2
Sample Matrix	Ground Water
Sample Date	19/07/2021

Parameter	Units	RL	L1	Result
Metals and Inorganics (continued)				
Antimony	µg/L	0.9	20	< 0.9
Selenium	µg/L	0.04	100	0.48
Uranium	µg/L	0.002	5	2.31
Vanadium	µg/L	0.01	6	4.25
Tungsten	µg/L	0.02	30	0.24
Zinc	µg/L	2	20	8
Zirconium	µg/L	2	4	< 2
Other (ORP)				
pH	No unit	5	8.5	7.52
Chloride	mg/L	0.04		1300
Mercury (dissolved)	mg/L	0.00001		< 0.00001

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E L1
BH2				
Cobalt	SM 3030/EPA 200.8	µg/L	0.925	0.9
Copper	SM 3030/EPA 200.8	µg/L	4.3	1
Iron	SM 3030/EPA 200.8	ug/L	1960	300
Lead	SM 3030/EPA 200.8	µg/L	1.17	1
Phosphorus	SM 3030/EPA 200.8	mg/L	0.080	0.01

QC SUMMARY

QCR_SubCategory

Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0325-JUL21	NTU	0.10	< 0.10	3	10	99	90	110	NA		

Alkalinity

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0309-JUL21	mg/L as CaCO3	2	< 2	0	20	102	80	120	NA		

Ammonia by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0220-JUL21	mg/L	0.04	<0.04	ND	10	99	90	110	100	75	125

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0317-JUL21	mg/L	0.05	<0.05	13	20	96	90	110	95	75	125
Nitrate (as N)	DIO0317-JUL21	mg/L	0.006	<0.006	0	20	102	90	110	100	75	125
Nitrite (as N)	DIO0324-JUL21	mg/L	0.003	<0.003	ND	20	95	90	110	97	75	125
Sulphate	DIO0324-JUL21	mg/L	0.04	<0.04	0	20	103	90	110	89	75	125
Chloride	DIO0350-JUL21	mg/L	0.04	<0.04	1	20	103	90	110	101	75	125

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-IENVISFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Organic Carbon	SKA0210-JUL21	mg/L	1	<1	1	10	98	90	110	96	75	125

QC SUMMARY

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0309-JUL21	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0309-JUL21	mg/L as CaCO3	2	< 2	0	10	NA	90	110	NA		
OH	EWL0309-JUL21	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

Colour

Method: SM 2120 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0389-JUL21	TCU	3	< 3	ND	10	100	80	120	NA		

QC SUMMARY

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0309-JUL21	uS/cm	2	< 2	0	20	99	90	110	NA		

Flouride by Specific Ion Electrode

Method: SM 4500 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0329-JUL21	mg/L	0.06	<0.06	ND	10	100	90	110	101	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (dissolved)	EHG0018-JUL21	mg/L	0.00001	< 0.00001	ND	20	NV	80	120	98	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0125-JUL21	ug/L	0.05	<0.00005	ND	20	103	90	110	94	70	130
Aluminum (0.2µm)	EMS0125-JUL21	mg/L	0.001	<1	ND	20	108	90	110	110	70	130
Arsenic	EMS0125-JUL21	ug/L	0.2	<0.0002	ND	20	105	90	110	104	70	130
Barium	EMS0125-JUL21	ug/L	0.02	<0.00002	ND	20	100	90	110	109	70	130
Beryllium	EMS0125-JUL21	ug/L	0.007	<0.00007	ND	20	90	90	110	99	70	130
Boron	EMS0125-JUL21	ug/L	2	<0.002	ND	20	99	90	110	106	70	130
Calcium	EMS0125-JUL21	mg/L	0.01	<0.01	ND	20	102	90	110	100	70	130
Cadmium	EMS0125-JUL21	ug/L	0.003	<0.000003	ND	20	102	90	110	105	70	130
Cobalt	EMS0125-JUL21	ug/L	0.004	<0.000004	ND	20	105	90	110	99	70	130
Chromium	EMS0125-JUL21	ug/L	0.08	<0.00008	ND	20	106	90	110	107	70	130
Copper	EMS0125-JUL21	ug/L	0.2	<0.0002	ND	20	104	90	110	99	70	130
Iron	EMS0125-JUL21	ug/L	7	<0.007	ND	20	99	90	110	100	70	130
Potassium	EMS0125-JUL21	mg/L	0.009	<0.009	ND	20	108	90	110	92	70	130
Magnesium	EMS0125-JUL21	mg/L	0.001	<0.001	ND	20	103	90	110	97	70	130
Manganese	EMS0125-JUL21	ug/L	0.01	<0.00001	ND	20	104	90	110	101	70	130
Molybdenum	EMS0125-JUL21	ug/L	0.04	<0.00004	ND	20	102	90	110	100	70	130
Sodium	EMS0125-JUL21	mg/L	0.01	<0.01	ND	20	101	90	110	97	70	130
Nickel	EMS0125-JUL21	ug/L	0.1	<0.0001	ND	20	105	90	110	92	70	130
Lead	EMS0125-JUL21	ug/L	0.01	<0.00001	ND	20	108	90	110	118	70	130
Phosphorus	EMS0125-JUL21	mg/L	0.003	<0.003	ND	20	104	90	110	NV	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Antimony	EMS0125-JUL21	ug/L	0.9	<0.0009	ND	20	98	90	110	99	70	130
Selenium	EMS0125-JUL21	ug/L	0.04	<0.00004	ND	20	99	90	110	100	70	130
Silicon	EMS0125-JUL21	ug/L	20	<0.02	ND	20	100	90	110	NV	70	130
Tin	EMS0125-JUL21	ug/L	0.06	<0.00006	ND	20	99	90	110	NV	70	130
Strontium	EMS0125-JUL21	ug/L	0.02	<0.00002	ND	20	103	90	110	99	70	130
Titanium	EMS0125-JUL21	ug/L	0.05	<0.00005	ND	20	108	90	110	NV	70	130
Thallium	EMS0125-JUL21	ug/L	0.005	< 0.005	ND	20	99	90	110	110	70	130
Uranium	EMS0125-JUL21	ug/L	0.002	<0.000002	ND	20	98	90	110	110	70	130
Vanadium	EMS0125-JUL21	ug/L	0.01	<0.00001	ND	20	105	90	110	103	70	130
Tungsten	EMS0125-JUL21	ug/L	0.02	<0.00002	ND	20	98	90	110	NV	70	130
Zinc	EMS0125-JUL21	ug/L	2	<0.002	ND	20	104	90	110	106	70	130
Zirconium	EMS0125-JUL21	ug/L	2	<0.002	ND	20	96	90	110	NV	70	130

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0309-JUL21	No unit	5	NA	1		100			NA		

Reactive Phosphorus by SFA

Method: SM 4500-P F I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus (total reactive)	SKA0204-JUL21	mg/L	0.03	<0.03	ND	10	100	90	110	77	75	125

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 025673 Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Lorena Rossi
Received By (signature):
Received Date: 07/19/2021 (mm/dd/yy)
Received Time: 13:45 (hr : min)
Custody Seal Present: Yes ☐ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: ice
Temperature Upon Receipt (°C): 9c, 9c, 9c
LAB LIMS #: CA-14399-JUL21

REPORT INFORMATION

Company: TERRAPROBE INC.
Contact: MARIAM AL-GAILANI
Address: 11 INDELL LN.
BRAMPTON, ON L6T 3Y3
Phone: 905-796-2650
Fax:
Email: MALGAILANI@TERRAPROBE.CA

INVOICE INFORMATION

☐ (same as Report Information)
Company: TERRAPROBE INC.
Contact: LORENA ROSSI
Address: 11 INDELL LN.
BRAMPTON ON L6T 3Y3
Phone: 905-796-2650
Email: LROSSI@TERRAPROBE.CA

Quotation #:
P.O. #:
Project #: 1-21-0168
Site Location/ID: 2834 OLD FORT RD, MIDLAND

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)
TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:
*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture:
☐ Table 2 ☐ Ind/Com ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ Medium/Fine
☐ Table _____ Appx. _____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☑ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA
☐ ODWS Not Reportable *See note

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M&I: Metals & Inorganics (incl CrVI, CN,Hg pH,(B(HWS),EC,SAR–soil) (Cl, Na-water)	M&I: Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI	M&I: ICP Metals only (Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni,	SVOC: PAHs only	SVOC: SVOCs (all incl PAHs, ABNs, CPs	PCB: PCBs Total ☐ Aroclor ☐	PHC: F1-F4 + BTEX	PHC: F1-F4 only (no BTEX	VOC: VOCs (all incl BTEX	VOC: BTEX only	Pest: Pesticides (Organochlorine or specify other	Other (please specify): pH & O	Other	Other	Other	Sewer Use: (Specify pkg:)	Water Characterization Pkg: General ☐ Extended ☐	SPLP: Specify tests: ☐ Metals ☐ VOC ☐ 1,4-Dioxane ☐ OCP ☐ ABN	TCLP: Specify tests: ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.	COMMENTS:
1	BH2	19/07/21		8	GW	N												X							
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

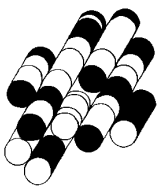
Observations/Comments/Special Instructions

Sampled By (NAME): SYED ALI Signature: Date: 07/19/21 (mm/dd/yy)
Relinquished by (NAME): SYED ALI Signature: Date: 07/19/21 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

APPENDIX G

TERRAPROBE INC.



CONSTRUCTION NORTH

EXISTING SNOWMOBILE TRAIL TO REMAIN

R.O.W

℄ NORTH ABUT. BRGS.

5500 WINGWALL

℄ EXIST. ABUT.

℄ EXIST. PIER

℄ TRANS CANADA TRAIL

30000

EMBANKMENT ENCROACHING BEYOUND ROW

℄ SOUTH ABUT. BRGS.

6000 WINGWALL

℄ EXIST. PIER

℄ EXIST. ABUT.

1447

3700

914 | 3500 EXISTING LANE | 7924 | 3500 EXISTING LANE | 914 = 9752

TO HWY. 12

W.P. 1
STA. 10+566.295
T/A EL. 193.707

10600 NEW BRIDGE

1500 | 3500 | 3500 | 1500

32.4° SKEW

EXIST. BRIDGE TO BE REMOVED

W.P. 2
STA. 10+596.295
T/A EL. 194.485

APPROACH SLAB W/90mm ASPHALT (TYP.)

℄ NEW AND EXIST. BRIDGE & OLD FORT ROAD

TO ELLIOT SIDE ROAD

FACE OF ABUTMENT

CONC. PARAPET WALL WITH RAILING

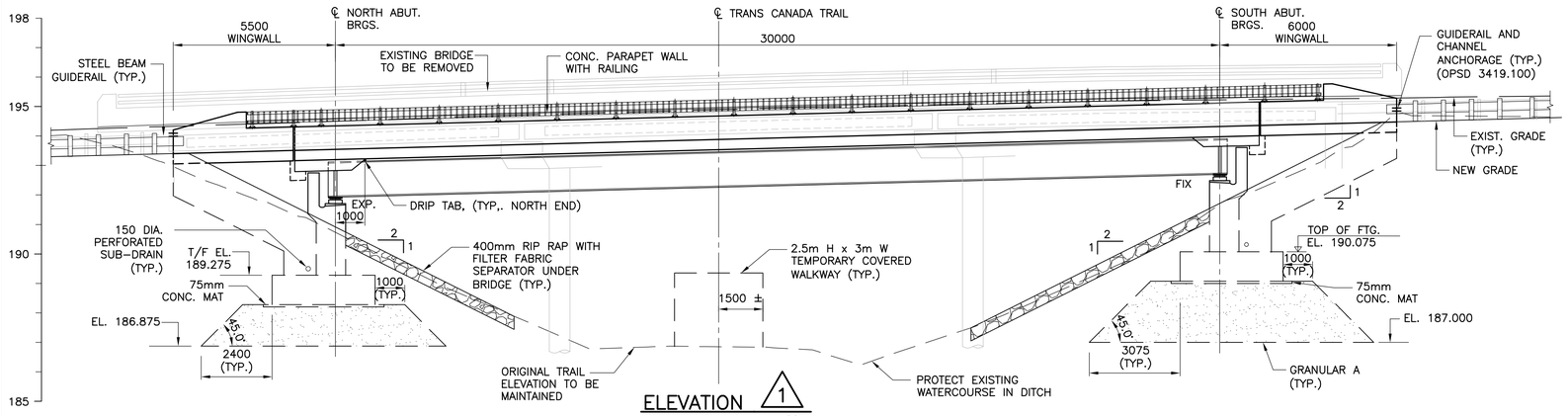
300

5m (TYP.)

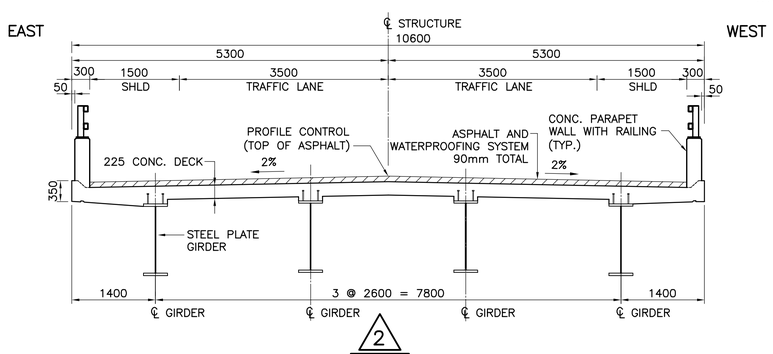
39012 EXISTING BRIDGE

FACE OF ABUTMENT

PLAN
1:100

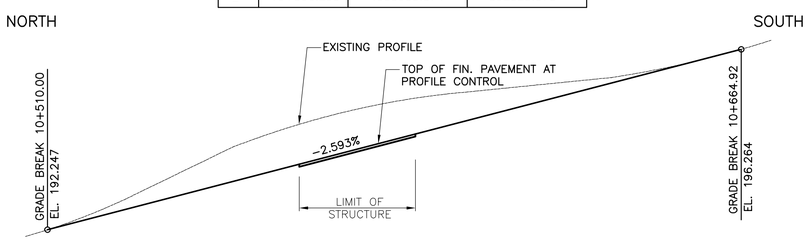


ELEVATION 1
1:100



2
1:50

WP #	STATION	NORTH COORDINATE	EAST COORDINATE
1	10+566.295	4953961.072	592507.091
2	10+596.295	4953935.874	592523.373



PROFILE OF OLD FORT ROAD
N.T.S.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

CONT No

OLD FORT ROAD BRIDGE
GENERAL ARRANGEMENT

SHEET —

LEA Consulting Ltd.
Consulting Engineers and Planners
www.LEA.ca

COUNTY OF SIMCOE
For the Greater Good

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

GENERAL NOTES:

CLASS OF CONCRETE.....30 MPa

CLEAR COVER TO REINFORCING STEEL

FOOTING.....100±25
DECK TOP.....70±20
BOTTOM.....40±10
REMAINDER (UNLESS NOTED OTHERWISE).....70±20

REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.

TENSION LAP LENGTHS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS B.

BAR MARKS WITH PREFIX "S" DENOTE STAINLESS STEEL BARS. STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE MINIMUM YIELD STRENGTH OF 500 MPA.

BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS. WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWING SS12–1, UNLESS INDICATED OTHERWISE.

GLASS FIBRE REINFORCED POLYMER REINFORCING BARS SHALL BE GRADE I, GRADE II OR GRADE III AS SPECIFIED IN THE CONTRACT DRAWINGS.

THE NOMINAL DIAMETER, TENSILE MODULUS OF ELASTICITY AND GUARANTEED MINIMUM TENSILE STRENGTH SHALL BE AS SPECIFIED IN THE CONTRACT DOCUMENTS.

BAR MARKS WITH THE PREFIX GI DENOTE GRADE I GLASS FIBRE REINFORCED POLYMER BARS.

BAR MARKS WITH THE PREFIX GII DENOTE GRADE II GLASS FIBRE REINFORCED POLYMER BARS.

BAR MARKS WITH THE PREFIX GIII DENOTE GRADE III GLASS FIBRE REINFORCED POLYMER BARS.

CONSTRUCTION

1. THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.
2. BACKFILL BEHIND ABUTMENTS SHALL NOT BE PLACED UNTIL CONC. IN THE ABUTMENT HAS REACHED A STRENGTH OF 25 MPa.

LIST OF ABBREVIATIONS:

ABUT.	– ABUTMENT
BRGS.	– BEARINGS
CONC.	– CONCRETE
℄	– CENTRELINE
DIA.	– DIAMETER
EL.	– ELEVATION
EXIST.	– EXISTING
FIN.	– FINISHED
FTG.	– FOOTING
HWY.	– HIGHWAY
N.T.S.	– NOT TO SCALE
SHLD.	– SHOULDER
STA.	– STATION
T/F	– TOP OF FOOTING
TYP.	– TYPICAL
W.P.	– WORKING POINT

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BOREHOLE LOCATIONS AND SOIL STRATA
3. SOIL STRATA
4. FOUNDATION LAYOUT AND DETAILS
5. ABUTMENTS
6. WINGWALLS
7. BEARINGS
8. STRUCTURAL STEEL – I
9. STRUCTURAL STEEL – II
10. DECK DETAILS
11. DECK REINFORCING
12. PARAPET WALL FOR COMBINATION TRAFFIC/BICYCLE RAIL, TL–4
13. RAILING ON PARAPET FOR COMBINATION TRAFFIC/BICYCLE RAIL, TL–4
14. APPROACH SLAB
15. STANDARD DRAWING

APPLICABLE STANDARD DRAWINGS:

MTOD–912.450	GUIDE RAIL SYSTEM, STEEL BEAM STRUCTURE CONNECTION, TUBE RAILING INSTALLATION
OPSD–3101.150	WALLS, ABUTMENT, BACKFILL, MINIMUM GRANULAR REQUIREMENT
OPSD–3102.100	WALLS, ABUTMENT, BACKFILL DRAIN
OPSD–3370.100	DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD
OPSD–3370.101	DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTS

DRAFT

REVISIONS | DESCRIPTION

DESIGN MR | CHK SS | CODE CHBDC 19 | LOAD ONT CL-625 | DATE JAN 2021
DRAWN DT | CHK MR | SITE | STRUCT | SCHEME | DWG 1

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